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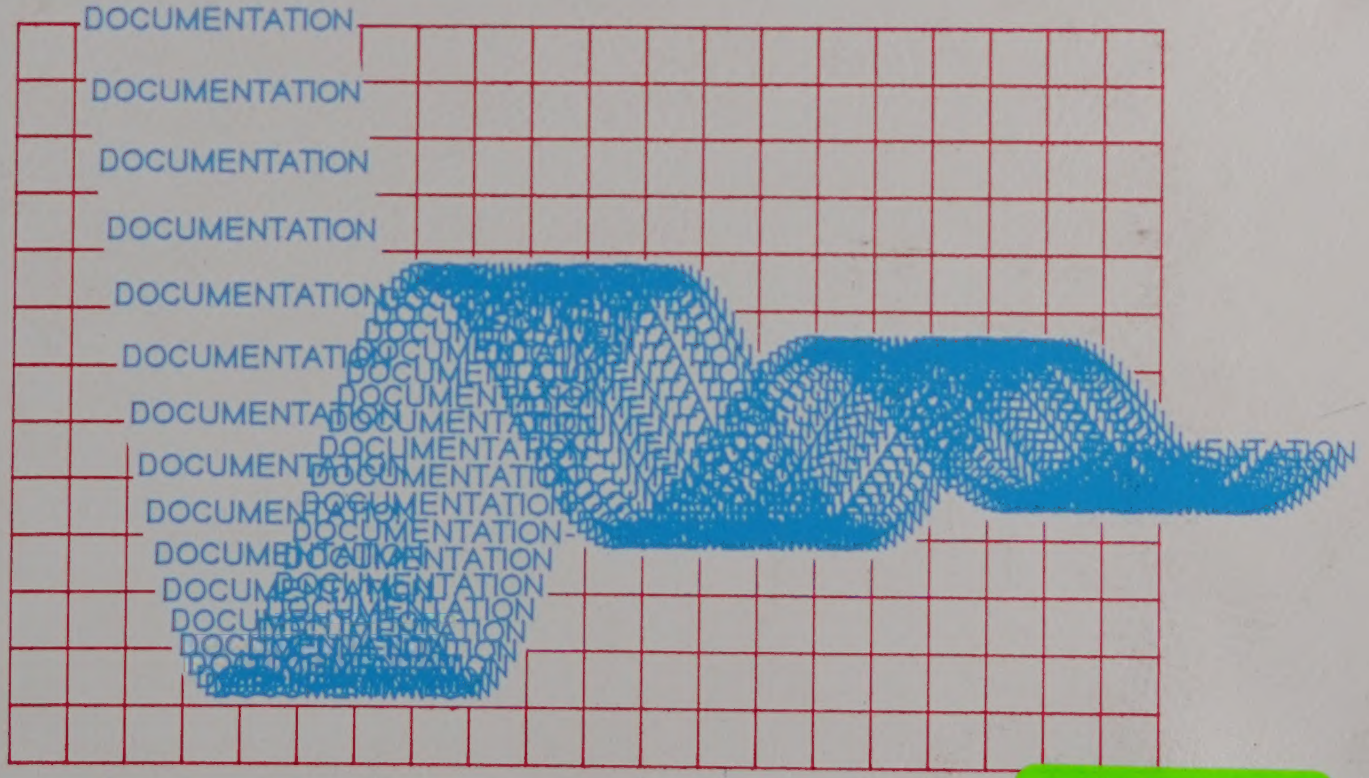

MP MASTER

MA20695

ROHDE&SCHWARZ
Test and Measurement
Division

Operating Manual

OPTION: SIGNAL VECTOR ANALYSIS FOR SPECTRUM ANALYZER FSE

FSE-B7

1066.4317.02

Printed in the Federal
Republic of Germany

Certified Quality System

ISO 9001

DQS REG. NO 1954-04

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Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist nach ISO 9001 zertifiziert.

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Certificat de qualité

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Le système de gestion qualité de Rohde & Schwarz a été homologué conformément à la norme ISO 9001.

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Safety Instructions

This unit has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

To maintain this condition and to ensure safe operation, the user must observe all instructions and warnings given in this operating manual.

1. The unit may be used only in the operating conditions and positions specified by the manufacturer. Unless otherwise agreed, the following applies to R&S products:

   Pollution severity 2, overvoltage category 2, IP degree of protection 2X, altitude max. 2000 m.

   The unit may be operated only from supply networks fused with max. 16 A.

2. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures should be taken to avoid any hazards.

   (using, for example, appropriate measuring equipment, fusing, current limiting, electrical separation, insulation).

3. If the unit is to be permanently wired, the PE terminal of the unit must first be connected to the PE conductor on site before any other connections are made (installation and cabling of the unit to be performed only by qualified technical personnel).

4. For permanently installed units without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused such as to provide suitable protection for the users and equipment.

5. Prior to switching on the unit, it must be ensured that the nominal voltage set on the unit matches the nominal voltage of the AC supply network.

   If a different voltage is to be set, the power fuse of the unit may have to be changed accordingly.

6. Units of protection class I with disconnectible AC supply cable and appliance connector may be operated only from a power socket with earthing contact and with the PE conductor connected.

7. It is not permissible to interrupt the PE conductor intentionally, neither in the incoming cable nor on the unit itself as this may cause the unit to become electrically hazardous.

   Any extension lines or multiple socket outlets used must be checked for compliance with relevant safety standards at regular intervals.

8. If the unit has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases it must be ensured that the power plug is easily reachable and accessible at all times (length of connecting cable approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply.

   If units without power switches are integrated in racks or systems, a disconnecting device must be provided at system level.

9. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

   Prior to performing any work on the unit or opening the unit, the latter must be disconnected from the supply network.

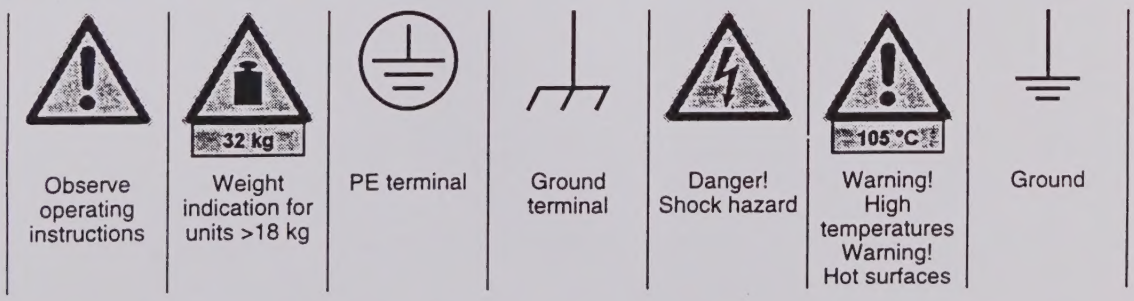
   Any adjustments, replacements of parts, maintenance or repair may be carried out only by authorized R&S technical personnel.

   Only original parts may be used for replacing parts relevant to safety (eg power switches, power transformers, fuses). A safety test must be performed after each replacement of parts relevant to safety.

   (visual inspection, PE conductor test, insulation-resistance, leakage-current measurement, functional test).

10. Any additional safety instructions given in this manual are also to be observed.

Safety-related symbols used on equipment and documentation from R&S:



Observe operating instructions	Weight indication for units >18 kg	PE terminal	Ground terminal	Danger! Shock hazard	Warning! High temperatures Warning! Hot surfaces	Ground

Supplement
to Operating Manual
Vector Signal Analysis, Option FSE-B7
(Firmware Version 1.52

The firmware version 1.52 contains the following supplementary remote control commands and extensions:

1. The results of the FSK-measurement can be queried, too:

CALCulate<1|2>:MARKer<1...4>:FUNCtion:DDEMod:RESult? DEV | FSRM | FSPK | FSPS

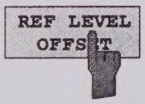
where	DEV	FSK-query error
	FSRM	FSK-error in %rms
	FSPK	FSK-error maximum in %pk
	FSPS	symbol number with the FSK-error maximum

2. For the vector ananyzer mode, the following two standards can be set in addition:

[SENSe:]DDEMod:PRESet DECT | CT2 | ERMes | MODacom | WCPE | TFTS | F16 | F322 | F324 | F64 | FQCDMA | RQCDMA

where	FQCDMA	forward CDMA according to IS95 standard
	RQCDMA	reverse CDMA according to IS95 standard
	F16	FLEX 1600 - 2FSK
	F322	FLEX 3200 - 2FSK,
	F324	FLEX 3200 - 4FSK
	F64	FLEX 6400 - 4FSK

3. The *REF LEVEL OFFSET* soft key was added to the *LEVEL REF* menu.



The soft key activates the entry of an arithmetic offset (± 200 dB in 0.1 dB steps) to the level.
The offset is added to the measured level independent of the selected units. The scaling of the y axis is changed accordingly.

Contens

Index

Data sheet

1 Preparation for Use 1.1-1

2.2 Menu Overview 2.2-1

2.2.1 SYSTEM Key Group 2.2-1
2.2.2 CONFIGURATION Key Group 2.2-4
2.2.3 HARDCOPY Key Group 2.2-5
2.2.4 FREQUENCY Key Group 2.2-6
2.2.5 LEVEL Key Group, INPUT Key 2.2-7
2.2.6 MARKER Key Group 2.2-9
2.2.7 LINES Key Group 2.2-10
2.2.8 TRACE Key Group 2.2-11
2.2.9 SWEEP Key Group 2.2-12
2.2.10 MEMORY Key Group 2.2-13
2.2.11 USER Key Group 2.2-13

2.4 Vector Analyzer Mode 2.4-1

2.4.1 Selecting the Operating Mode 2.4-2
2.4.3 Digital Modulation Methods 2.4-9
2.4.3.1 Selecting the Digital Demodulators 2.4-11
2.4.3.2 Standard Settings 2.4-12
2.4.3.3 Selecting Modulation Parameters for Digital Demodulation 2.4-14
2.4.3.4 Selecting Measurement Results for Digital Demodulation 2.4-18
2.4.3.4.1 Magnitude of Capture Buffer 2.4-18
2.4.3.4.2 Measurement or Reference Signal 2.4-19
2.4.3.4.3 Measurement of Modulation Errors 2.4-26
2.4.3.4.4 Symbol Table and Table of Modulation Errors 2.4-28
2.4.3.5 Selecting Memory Size, Demodulation Length and Display Range 2.4-32
2.4.4 Setting the Frequency - FREQUENCY Key Block 2.4-36
2.4.5 Setting the Frequency Span 2.4-37
2.4.6 Setting the Level Display and Configuring the RF Input 2.4-38
2.4.6.1 Setting the Reference Level 2.4-38
2.4.6.2 Setting the Display Range and Scaling - RANGE Key 2.4-40
2.4.6.3 Configuration of RF Input in Vector Signal Analysis 2.4-45
2.4.7 Selection and Setting of Traces - TRACE Key Block 2.4-46
2.4.8 Setting the Analog Bandwidth - SWEEP Key Block 2.4-49
2.4.9 Sweep Menu 2.4-51
2.4.10 Triggering Data Storage 2.4-53

2.4.11 MARKER Key Block 2.4-63
2.4.11.1 Main Marker - NORMAL Key 2.4-63
2.4.11.2 Delta Marker - DELTA Key 2.4-66
2.4.11.3 Search Functions (Marker Search menu) - SEARCH Key 2.4-67
2.4.11.4 Varying Instrument Settings by means of Markers - MKR→Key 2.4-73
2.4.12 Setup of Display and Limit Lines – *LINES* Key Field 2.4-74
2.4.12.1 Display Lines – *D LINES Key* 2.4-74
2.4.12.2 Limit Lines – *LIMITS Key* 2.4-77
2.4.12.2.1 Limit Line Selection 2.4-79
2.4.12.2.2 Entry and Editing of Limit Lines 2.4-81

3.6 Description of Commands 3.6-1

3.6.1 Notation 3.6-1
3.6.2 Common Commands 3.6-4
3.6.3 ABORt Subsystem 3.6-7
3.6.4 CALCulate Subsystem 3.6-7
3.6.4.1 CALCulate:DELTamarker Subsystem 3.6-8
3.6.4.2 CALCulate:DLINe Subsystem 3.6-14
3.6.4.3 CALCulate:FEED Subsystem 3.6-17
3.6.4.4 CALCulate:FORMat Subsystem 3.6-18
3.6.4.5 CALCulate:LIMit Subsystem 3.6-19
3.6.4.6 CALCulate:MARKer Subsystem 3.6-24
3.6.4.7 CALCulate:UNIT Subsystem 3.6-39
3.6.5 CALibration Subsystem 3.6-40
3.6.6 DIAGnostic Subsystem 3.6-42
3.6.7 DISPlay Subsystem 3.6-43
3.6.8 FORMat Subsystem 3.6-47
3.6.9 HCOPy Subsystem 3.6-48
3.6.10 INITiate Subsystem 3.6-53
3.6.11 INPut Subsystem 3.6-54
3.6.12 INSTrument Subsystem 3.6-56
3.6.13 MMEMory Subsystem 3.6-57
3.6.14 OUTPut Subsystem 3.6-61
3.6.15 SENSe Subsystem 3.6-62
3.6.15.1 [SENSe]:AVERage Subsystem 3.6-62
3.6.15.2 SENSe:BANDwidth Subsystem 3.6-64
3.6.15.3 SENSe:DETector Subsystem 3.6-66
3.6.15.4 SENSe:DDEMod Subsystem 3.6-67
3.6.15.5 SENSe:FREQuency Subsystem 3.6-72
3.6.15.6 SENSe:POWer Subsystem 3.6-76
3.6.15.7 SENSe:ROSCillator Subsystem 3.6-78
3.6.15.8 SENSe:SWEep Subsystem 3.6-79
3.6.16 SOURce Subsystem 3.6-83
3.6.17 STATus Subsystem 3.6-85
3.6.18 SYSTem Subsystem 3.6-93
3.6.19 TRACe Subsystem 3.6-98
3.6.20 TRIGger Subsystem 3.6-99
3.6.21 UNIT Subsystem 3.6-102

Index

A

ALPHA/BT 2.4-16
ANALAOG BW AUTO 2.4-49
ANALOG BW MANUAL 2.4-49
AVERAGE/HOLD ON / OFF 2.4-71
Averaging
- Number of sweeps 2.4-47
- Single Sweep 2.4-47

B

Bandwidth, analog 2.4-49
BLANK 2.4-46

C

CLEAR/WRITE 2.4-46
CONTINUOUS WRITE 2.4-46
COUPLING 2.4-49

D

D Lines ..... see Lines
Demodulator, digital 2.4-11
Demodulator,standard setups 2.4-12
DIGITAL DEMOD 2.4-11
DIGITAL STANDARD 2.4-14
Display range 2.4-40

F

Find burst 2.4-55
Find sync 2.4-56
FREQUENCY 2.4-36
- line 2.4-74

Frequency setting 2.4-36
Frequency span 2.4-37

G

Gaussian filter 2.4-15

I

Input filter 2.4-15

K

Key
- D LINES 2.4-74

L

Level
- line 2.4-75

Limit line
- copy 2.4-80
- delete 2.4-81
- save 2.4-84
- select 2.4-79
- value 2.4-83

Line
- display 1,2 ..... 2.4-75
- limit 2.4-79
- threshold 2.4-75
- time 1, 2 ..... 2.4-76

M

Marker 2.4-63
- coupled 2.4-65
- delta 2.4-66
- Marker -> 2.4-73
- Min 2.4-68
- Peak 2.4-73
- polar diagram 2.4-64
- search 2.4-67
- Search Limit 2.4-69

MARKER INFO 2.4-65
MARKER NORMAL 2.4-63
Max Hold ..... see Peak-value averaging
MEAS FILTER 2.4-15
Measurement curve
- Minimum-value averaging 2.4-48
- Peak-value averaging 2.4-48

Min Hold ..... see Minimum-value averaging
Minimum-value averaging 2.4-48
Modulation parameters 2.4-14

N

NORMALIZE 2.4-17
Nyquist filter 2.4-16

P

Pattern
- name 2.4-61
- selection 2.4-61

PEAK HOLD ON / OFF 2.4-71
Peak-value averaging 2.4-48

R

Raised Cosine Filter 2.4-15
Range 2.4-40
Ref value position 2.4-42
Ref value X/Y axis 2.4-40
REFERENCE FILTER 2.4-15
Reference level 2.4-38
Reference signal 2.4-15
Result length 2.4-52
RF input, configuration 2.4-45

S

Save
- limit line 2.4-84

Scale unit 2.4-43
Signal to be measured 4-15
Soft key
- COPY LIMIT LINE 2.4-80
- DELETE LIMIT LINE 2.4-81
- DELETE VALUE (limit line) 2.4-84
- DISPLAY LINE 1/2 ..... 2.4-75
- EDIT LIMIT LINE 2.4-82
- INSERT VALUE (limit line) 2.4-83
- NAME (limit line) 2.4-82
- NEW LIMIT LINE 2.4-82
- REFERENCE LINE 2.4-75
- SAVE LIMIT LINE 2.4-84
- SELECT LIMIT LINE 2.4-79
- THRESHOLD LINE 2.4-75
- TIME LINE 1/2 ..... 2.4-76
- VALUES (limit line) 2.4-83

Softkey
MAIN PLL BANDWIDTH 2.4-50
Summary Marker 2.4-69
SWEEP 2.4-49
Sweep Count 2.4-52; 2.4-72
SWEEP, continuous 2.4-51
SWEEP, key 2.4-51
SWEEP, single 2.4-51
SYMBOL RATE 2.4-14
Symbol table 2.4-46
Sync offset 2.4-57
Sync pattern 2.4-61
Sync pattern, editing 2.4-62
Synchronization sequence 2.4-56

T

TRACE 2.4-46
Traces 2.4-46
Trigger 2.4-53
Trigger edge, pos./neg. 2.4-54
Trigger threshold 2.4-53
Trigger, EXTERN 2.4-54
Trigger, FREE RUN 2.4-53
Trigger, OFFSET 2.4-54
Trigger, VIDEO 2.4-53

U

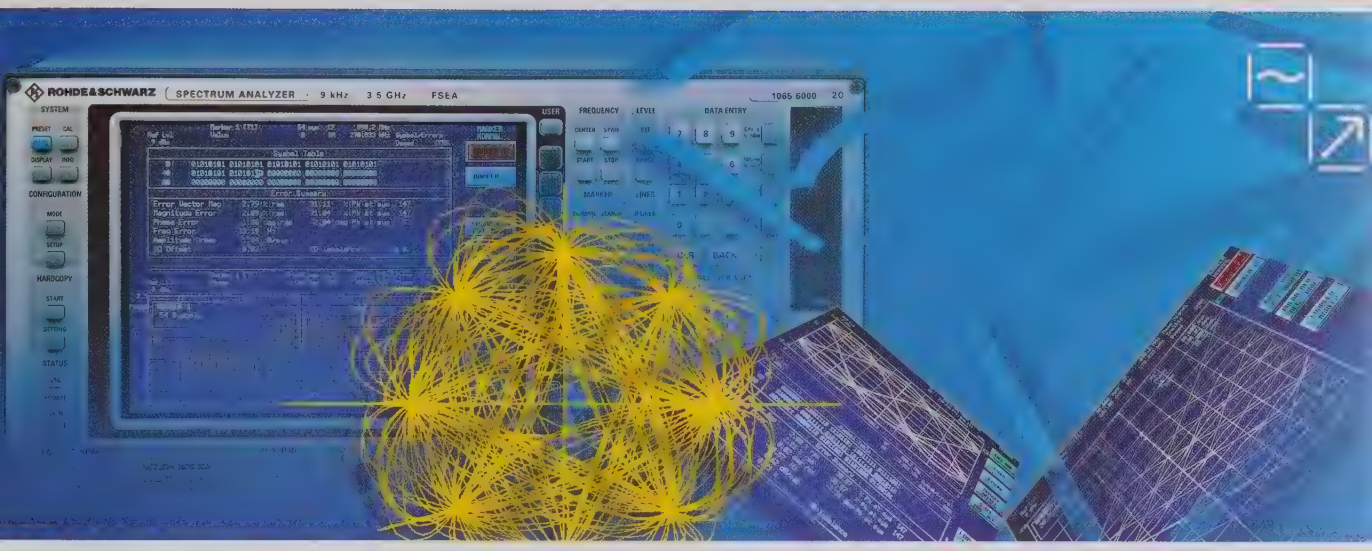
Unit 2.4-43

V

VIEW 2.4-46

Y

Y per div 2.4-40



Vector Signal Analyzer Option FSE-B7 for Spectrum Analyzers FSEA/FSEB

Universal demodulation, analysis and documentation of digital mobile radio signals

Spectrum Analyzers FSEA/FSEB from Rohde & Schwarz offer the wide dynamic range necessary for many measurements on digitally modulated signals. They provide fast, high-precision measurements of power level, power ramp, adjacent channel power, nonharmonics and intermodulation products.

The vector signal analyzer option upgrades the high-quality analyzers, adding universal demodulation and analysis capability down to bit stream level for digitally modulated mobile radio signals. The option supports all common mobile radio communication standards:

- GSM/DCS 1800/PCS 1900
- NADC
- TETRA
- PDC
- PHS

as well as the modulation modes

- BPSK
- QPSK
- π/4-DQPSK
- 8PSK
- (G)MSK

A variety of display types is available for optimum representation of results:

- In-phase and quadrature signals
- Magnitude, phase
- Eye and trellis diagrams
- Vector diagram
- Constellation diagram
- Table with modulation errors
- Demodulated bit stream

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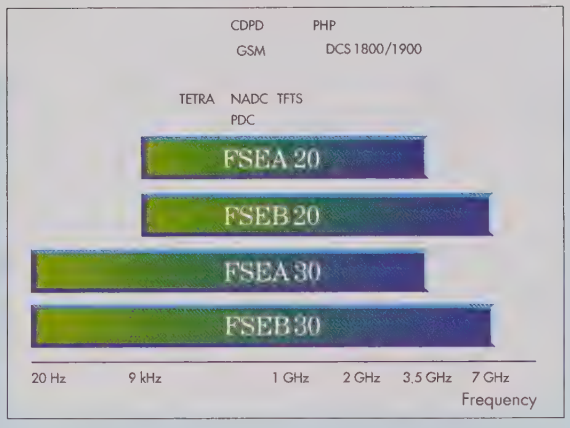
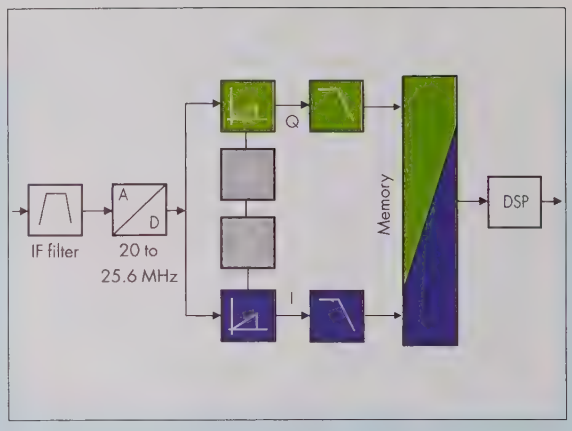
Characteristics



The vector signal analyzer option can be used with all analyzers of the FSE family to cover the frequency range up to 7 GHz for future-oriented applications



Operating principle of Vector Signal Analyzer Option FSE-B7

Versatile in the lab

You may want to develop future or company standards, use unconventional formats or modify synchronization sequences. In all these cases, FSEA/FSEB with Option FSE-B7 will support you by providing user-selectable bit and symbol rates, filters, modulation modes and synchronization sequences.

Efficient in production

The high measurement speed of 25 sweeps/s in the analyzer mode and typically 5 measurements/s using the vector signal analyzer function is ideal for applications in production. The high flexibility allows multistandard test systems to be configured for easy adaptation to varying production requirements.

Any mobile radio standard at a single keypress

The high flexibility offered by the analyzers is by no means at the price of complicated operations: All major digital modulation standards can be activated at a single keypress. The instrument is then completely configured for measurements in line with the activated standard. The corresponding limit lines and synchronization sequences are of course offered along with the standard.

Multiple test functions integrated in one unit

Analyzers FSEA/FSEB with Option FSE-B7 combine the functions of several instruments:

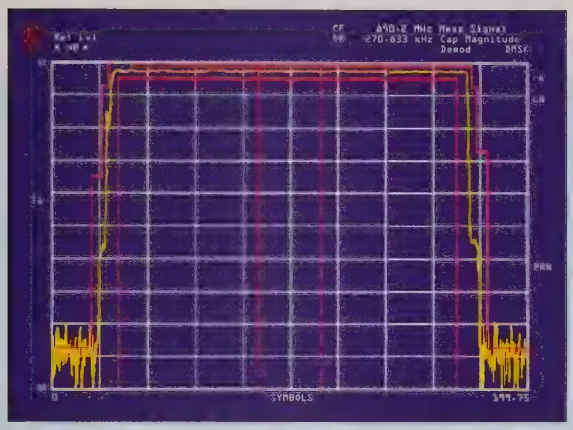
- high-grade spectrum analyzer
- vector demodulator
- constellation analyzer
- or process controller

The analyzers can easily be linked up to your Ethernet LAN by means of Option FSE-B16.

Principle of vector signal analysis

The IF signal is digitized by means of a fast A/D converter, allowing purely digital processing of all subsequent analysis steps, thus making them practically error-free and providing high long-term and temperature stability. After A/D conversion, the signal is digitally mixed into the baseband and split into a real and an imaginary component. The complete signal information is thus available for further analysis. The signal is demodulated down to bit level by several DSPs. From the data stream thus obtained, an ideal signal is calculated. This reference signal is compared with the test signal. The resulting difference signal contains all modulation errors. The sampling rate of the A/D converter is always set to an

Applications



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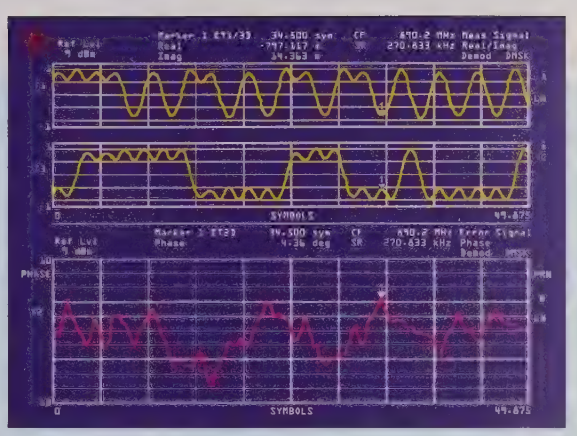

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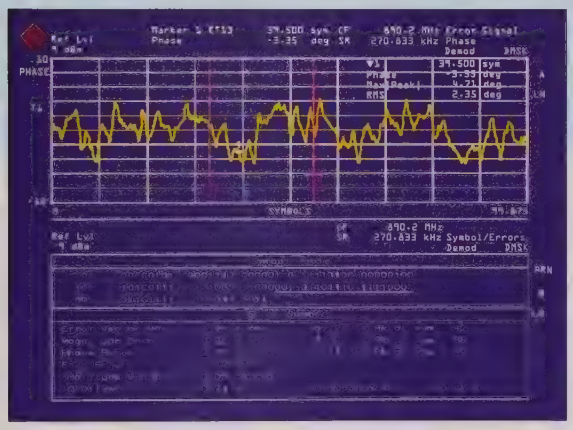


3

1 Measurement of GSM power ramps to standards with high-precision time reference through synchronization to mid-amble

2 I/Q signal and phase error measurement over 50 symbols of a GSM mobile

3 Phase error, demodulated bits and numeric readout for modulation errors

integer multiple of the symbol rate, which speeds up analysis and contributes towards the high rate of 5 measurements/s.

Applications

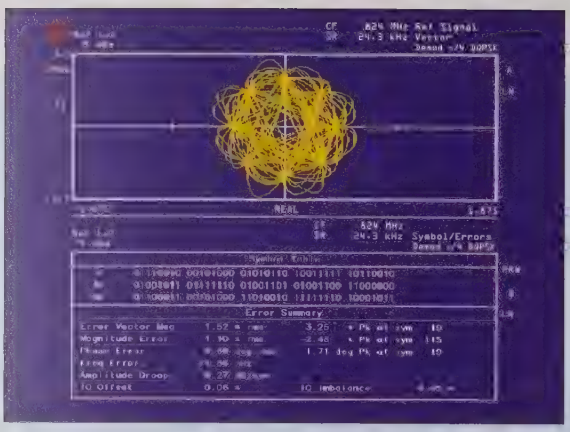
Power ramp measurements in line with standards (1)

To perform power ramp measurements on TDMA systems such as GSM in line with standards, a time reference must be established from synchronization sequences to pre- or mid-amble. This is done in the SYNC-SEARCH mode, in which the analyzer triggers on preset or user-defined bit sequences. This not only allows established standards to be measured with high precision, but also modified settings in the case of new developments. Further trigger modes are:

- video
- external
- burst search

Phase error measurements on GSM mobiles and base stations (2 and 3)

The low inherent phase error of <0.5° (rms) of Option FSE-B7 substantially reduces measurement uncertainty. Tolerances, eg an rms phase error of 5° for GSM, can thus be allowed practically completely for the DUT, thus widening the DUT tolerance margin. The SYMBOL TABLE/ERROR SUMMARY lists the demodulated bits and the errors found. The bit sequences and the errors can be read via the fast IEC/IEEE bus of the analyzer.



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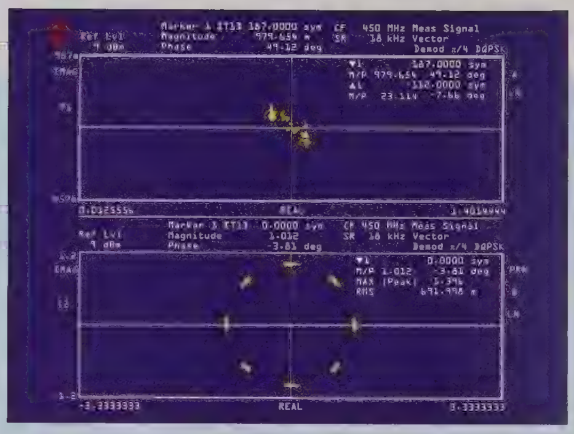

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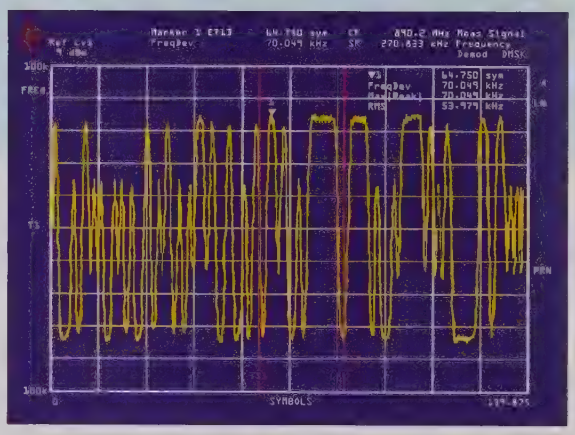

6

4 Measurement of modulation error of π/4-DQPSK signals (NADC)

5 Constellation diagram of TETRA signal with phase noise. Bottom: complete, top: expanded by factor of 5

6 Frequency response of GSM signal and automatic deviation measurement with modulation marker

The deviation can be rapidly determined from the frequency display by means of modulation markers.

Modulation error measurements on π/4-DQPSK signals (4)

The upper screen (A) shows the vector diagram of an NADC signal, the lower screen gives a summary of relevant errors, measured over a burst signal.

Convenient analysis with constellation diagram (5)

The constellation diagram enables convenient analysis of the degradation of modulation accuracy caused, for example, by nonlinearities, phase noise or amplitude-dependent phase response of amplifiers, converters, etc. The lower screen (B) shows the complete constellation diagram, the upper screen (A) a zoomed detail that allows an accurate examination of the test point distribution.

Frequency response of GSM signal (6)

The frequency deviation versus time characteristic – shown here as deviation versus symbols – is rms-weighted by means of the modulation marker. It is also possible to measure the rms deviation for any part of the burst, eg for the mid-amble.

Specifications

Specifications are guaranteed subject to the following conditions:

5 minutes warmup from ambient temperature, environmental conditions and calibration cycle met (see FSEA/FSEB data sheet) and self-calibration performed. Data without tolerances are typical values. Data denoted "nominal" provide functional performance information derived during the design process.

Digitally modulated signals

Signal types	continuous signals, TDMA signals
Modulation modes	BPSK, QPSK, DQPSK, π/4-DQPSK, 8PSK, MSK/GMSK
Standards	GSM/DCS 1800/PCS 1900, NADC, TETRA, PDC, PHS

Filters

Filter types	raised cosine, square root raised cosine, Gaussian
α/BT setting range	0.2 to 1 in steps of 0.05

Measurements

I and Q signals (filtered, synchronized to frequency and symbol clock), I and Q reference signals (calculated from demodulated bits), I and Q error (magnitude and phase), vector error, bit stream/modulation error (bits demodulated at ideal decision points and table of all modulation errors)

Display types

Polar diagram	constellation diagram, vector diagram
Time domain	in-phase and/or quadrature signals, magnitude (level), phase, eye diagram, trellis diagram
Error display in time domain	error vector magnitude (EVM) in %, phase/frequency error, in-phase and quadrature signals
Numerical error readout (* rms and peak value)	error vector magnitude (EVM)in %*, magnitude error*, phase error*, frequency error, I/Q offset, I/Q imbalance, amplitude droop

Modulation measurement range

Symbol rate	1.28 to 400 kHz (extendable up to 1.6 MHz)
Test points/symbol	
Symbol rate ≤200 kHz	1, 2, 4, 8, 16
Symbol rate >200 kHz	1, 2, 4, 8
Memory size	max. 16 000 samples
Number of demodulated symbols	max. 800 (selectable) (≤8 points per symbol) max. 400 (selectable) (16 points per symbol)

Synchronization

Symbol clock	internal
Frequency/phase	internal
Trigger	free run, external, video
Trigger offset	pre- or posttrigger
Synchronization on bit sequences	definable bit sequences, max. 32 symbols, TDMA bursts
Synchronization offset	selectable, positive or negative

Level measurement range

Peak power	–60 to +30 dBm
Dynamic range for burst measurements (peak power > –20 dBm)	80 dBc – 4 x log(symbol rate/kHz)

Level measurement error

Average power	
f ≤1 GHz	<1 dB
f >1 GHz	<1.5 dB
Time reference (nominal)	
without clock synchronization	<1/(2 x symbol rate x points/symbol)
with clock synchronization	<0.001 x symbol rate

Measurement times

Readout of detected symbols and numerical modulation errors, synchronized

GSM, DCS 1800/PCS 1900, PHS	330 ms/measurement
NADC, TETRA, PDC	600 ms/measurement

Residual error in modulation measurements

(level in range ref. level to ref. level –6 dB; S/N >60 dB, α/BT = 0.3 to 0.7, number of demodulated symbols >100, averaging ≥10, analog bandwidth >10 x symbol rate)

Input frequency	models 20	≥20 MHz
	models 30	>15 x symbol rate, local suppression calibrated

General modulation modes

	Symbol rate <30 kHz	Symbol rate ≥30 kHz
Error vector magnitude (EVM)	0.5% rms	1% rms
Magnitude error	0.5% rms	1% rms
Phase error (modulation modes with constant amplitude)	0.3° rms	0.5° rms
Frequency error	symbol rate x 5 x 10^{-6} + error of reference frequency (see data sheet FSEA/FSEB)	
I/Q offset error	0.2% (–54 dB)	

Modulation standards

		Error vector (magnitude)	Phase error
Standard	GSM (DCS 1800/PCS 1900)	–	≤0.5° rms, typ. <1.5% peak
	NADC/PDC/TETRA	≤0.7° rms, typ. <2% peak	–
	PHS	≤1° rms, typ. <3% peak	–

FSEA30 or FSEA20 with Option FSE-B4:
For frequencies ≥1 GHz, the specified data must be multiplied by $10^{0.552 \times \log(f/GHz)}$.

FSEB30 or FSEB20 with Option FSE-B4:
For frequencies <1 GHz, the specified data must be multiplied by 1.4, for frequencies ≥1 GHz additionally by $10^{0.354 \times \log(f/GHz)}$.

FSEA20 or FSEB20 without Option FSE-B4:
The specified data must be multiplied by a factor of typically 3.

General data

see data sheet "Spectrum Analyzer FSEA/FSEB"

Order designations

Spectrum Analyzer 9 kHz to 3.5 GHz	FSEA20	1065.6000.20
Spectrum Analyzer 20 Hz to 3.5 GHz	FSEA30	1065.6000.30
Spectrum Analyzer 9 kHz to 7 GHz	FSEB20	1066.3010.20
Spectrum Analyzer 20 Hz to 7 GHz	FSEB30	1066.3010.30
Vector Signal Analyzer Option for Spectrum Analyzers FSEA/FSEB	FSE-B7	1066.4317.02
Low Phase Noise and OCXO Option (for models 20)	FSE-B4	1073.5396.02

Further options and accessories
See data sheet "Spectrum Analyzer FSEA/FSEB", Order No. PD 757.1519

Certified Quality System
ISO 9001
DQS REG. NO 1954-02

ROHDE & SCHWARZ

ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · D-81671 München
P.O.B. 801469 · D-81614 München · Telephone +4989 4129-0 · Fax +4989 4129-3567

ROHDE&SCHWARZ

EC Certificate of Conformity

CE

Certificate No.: 9502052

This is to certify that:

Equipment type	Order No.	Designation
FSE-B1	1073.4990.02	Color Display
FSE-B15	1073.5696.02 /.03	Computer Function
FSE-B16	1073.5973.02 /.03	Ethernet Interface
FSE-B17	1066.4017.02	2nd IEC BUS Interface
FSE-B2	1073.5044.02	7 GHz Frequency Extension
FSE-B4	1073.5396.02	OCXO 10 MHz and Low Phase Noise
FSE-B7	1066.4317.02	Signal-Vectoranalysis

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electromagnetic compatibility
  (89/336/EEC revised by 91/263/EEC, 92/31/EEC)

Conformity is proven by compliance with the following standards:

EN50081-1 : 1992
EN50082-1 : 1992

Affixing the EC conformity mark as from 1995

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich,16.10.95

Central Quality Management FS-QZ / Becker

1 Preparation for Use

1.1 Introduction

This manual is an extension to the FSE manual and describes exclusively vector analysis functions. All other functions are described in the FSE manual. For a better orientation refer to the alphabetically arranged table below.

Subject	Section in FSE manual
Basic Steps of Operation	2.3
Emulations	Annex E
Firmware Update	1.8
Gereral Configuration	2.4
Interfaces	Annex A
List of Error Messages	Annex B
Macros	2.8
Measurement Documentation	2.6
Programming Examples	Annex D
Remote Control Command Processing and Status Reporting System	3.7 to 3.8
Remote Control Introduction	3.1 to 3.5
Saving and Recalling Data Sets	2.7
Setup of Display and Limit Lines	2.9.4
Status Display-Remote/Manual Control	2.5

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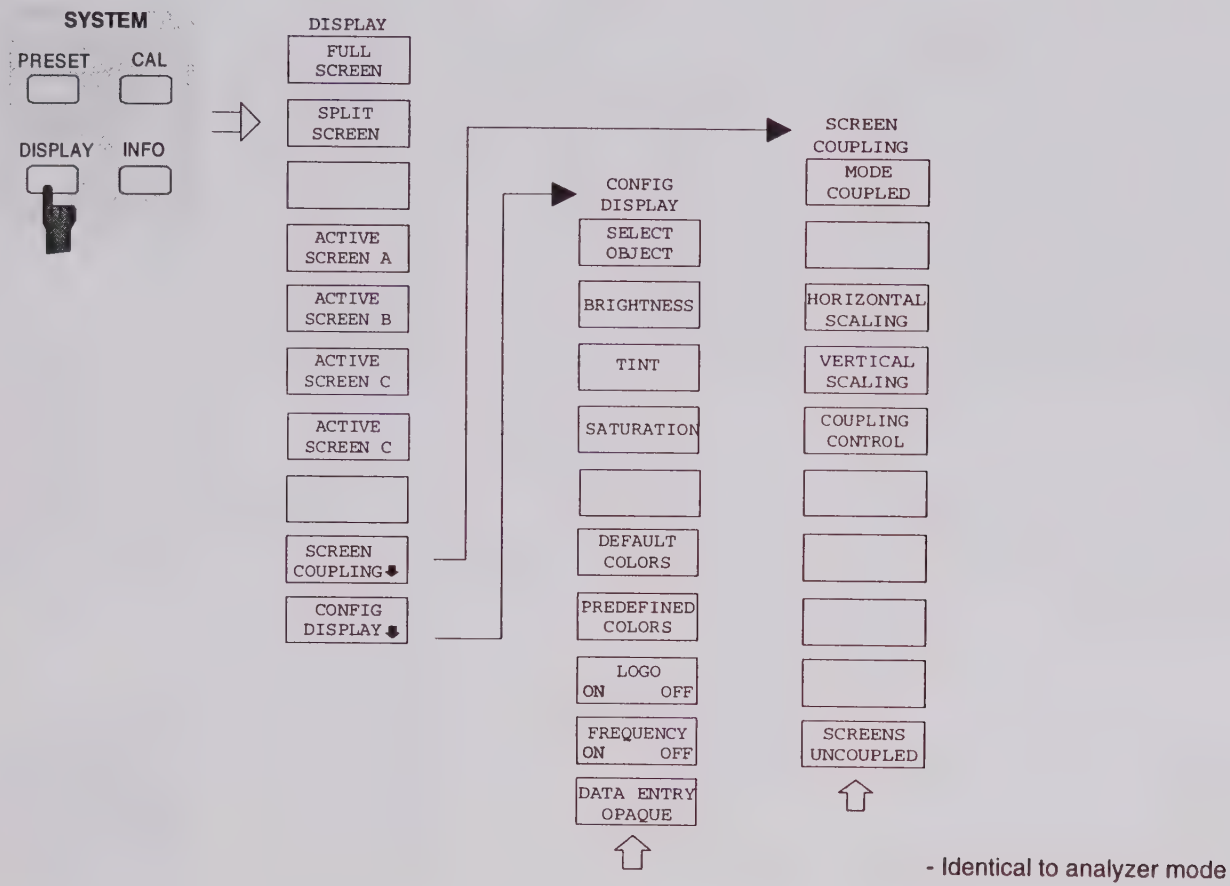
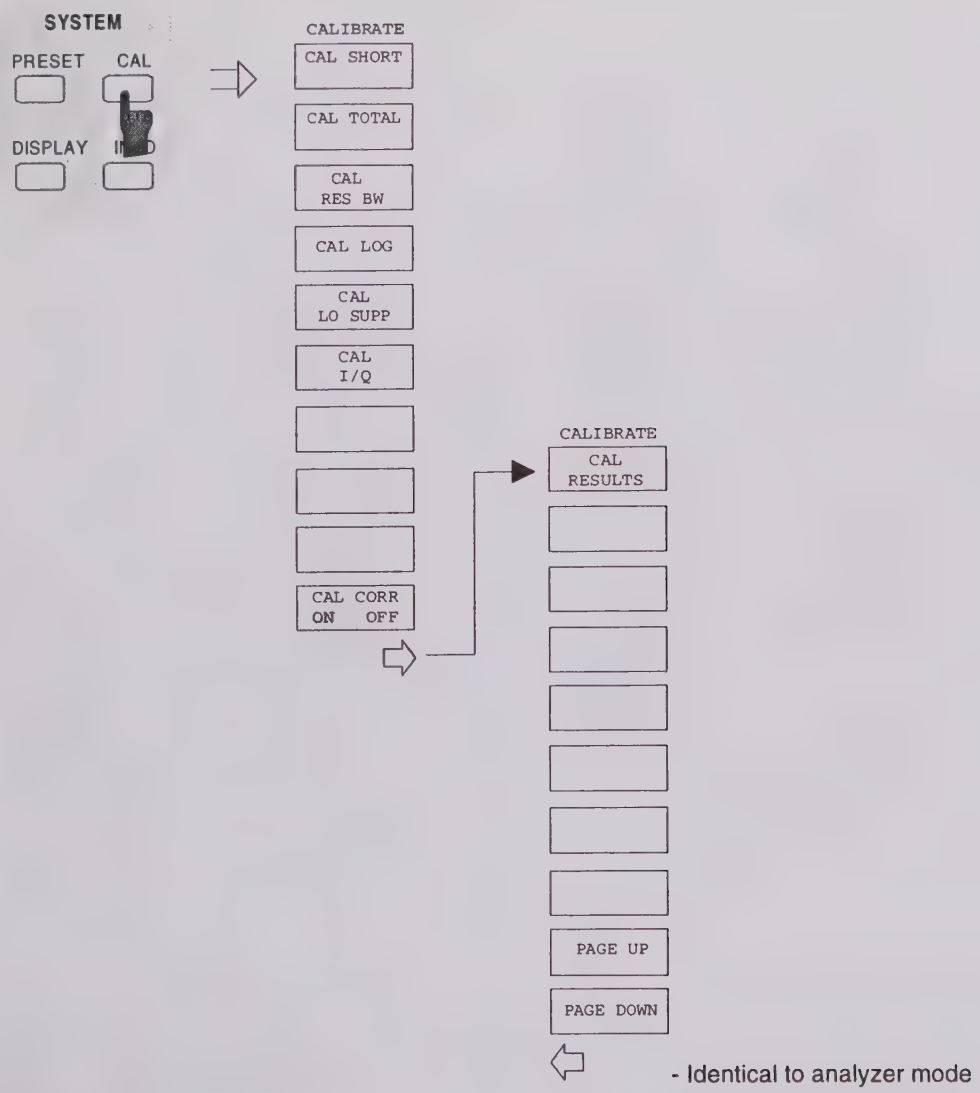
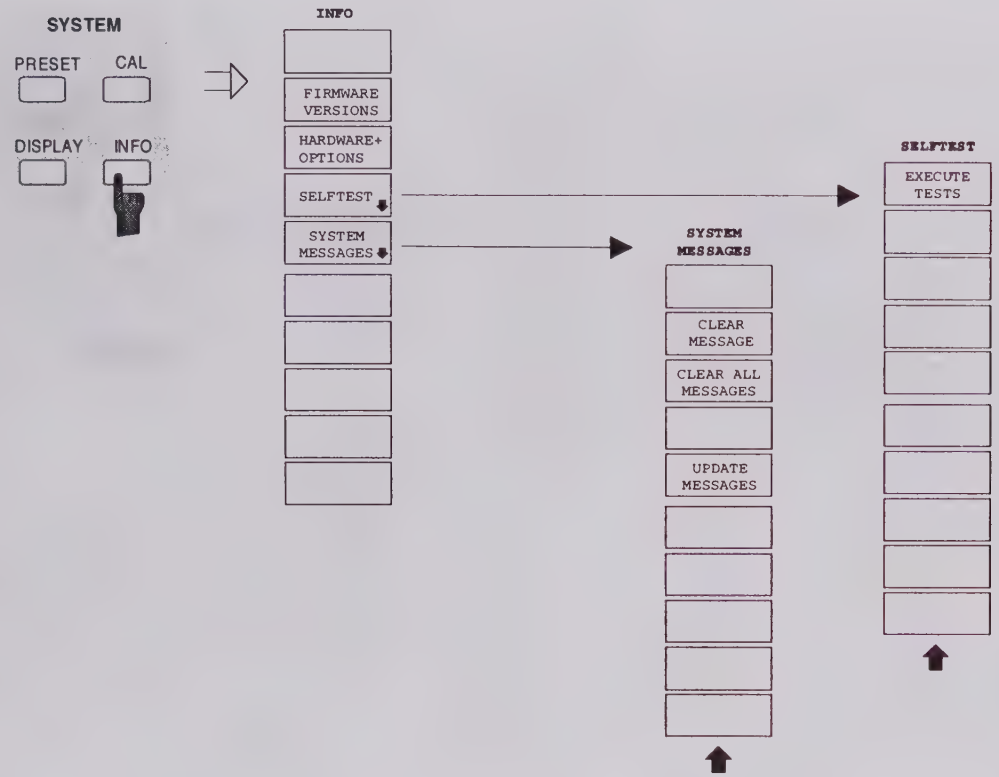
2.2 Menu Overview

2.2.1 SYSTEM Key Group



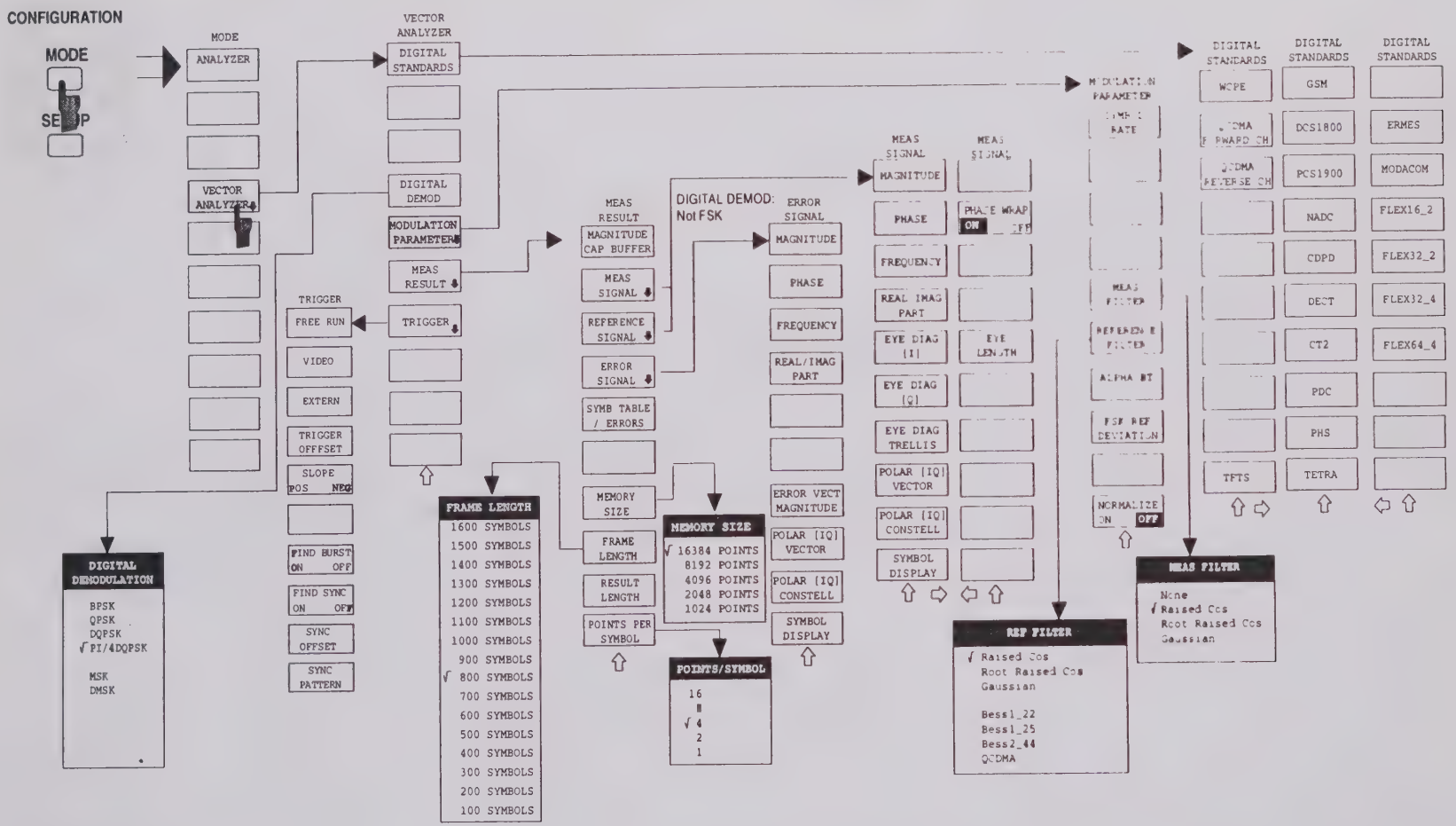
- Identical to analyzer mode


SYSTEM
PRESET
CAL
DISPLAY
CALIBRATE
CAL SHORT
CAL TOTAL
CAL RES BW
CAL LOG
CAL LO SUPP
CAL I/Q
CAL CORR ON OFF
CALIBRATE
CAL RESULTS
PAGE UP
PAGE DOWN
- Identical to analyzer mode

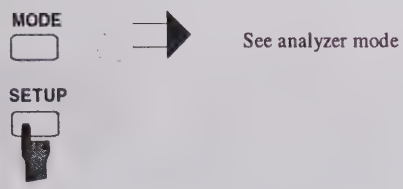


- Identical to analyzer mode

2.2.2 CONFIGURATION Key Group



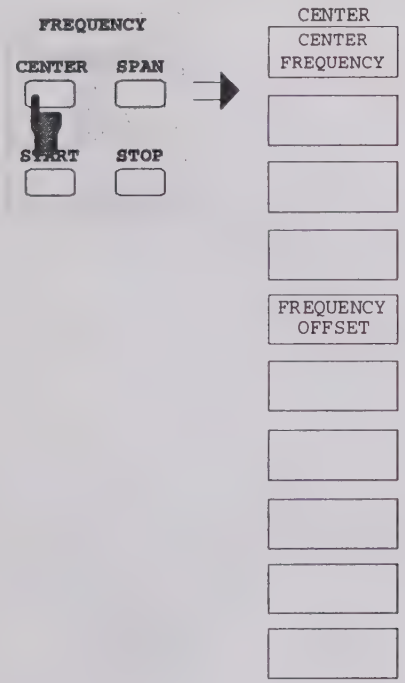
CONFIGURATION

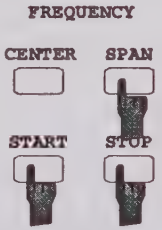


2.2.3 HARDCOPY Key Group

See analyzer mode

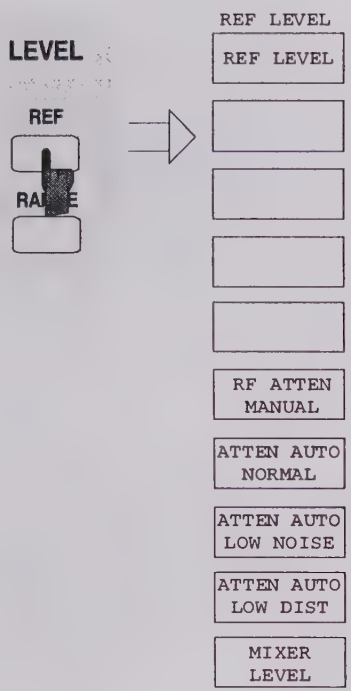
2.2.4 FREQUENCY Key Group

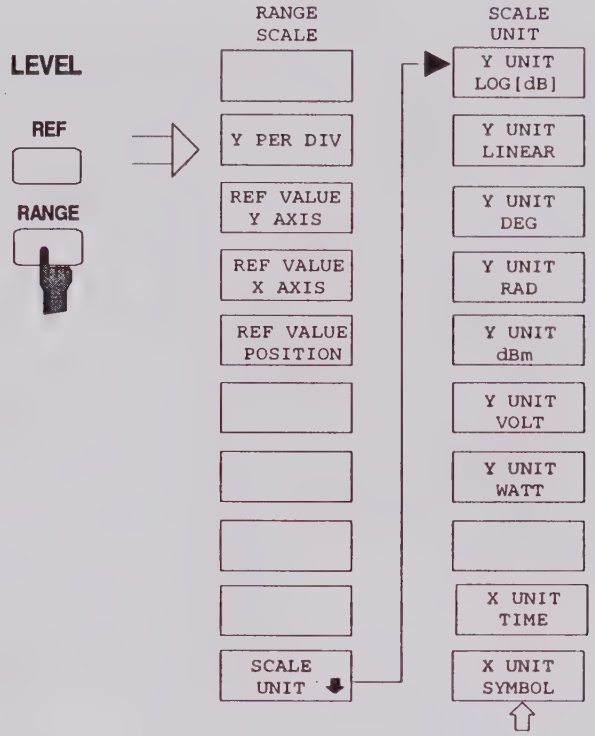


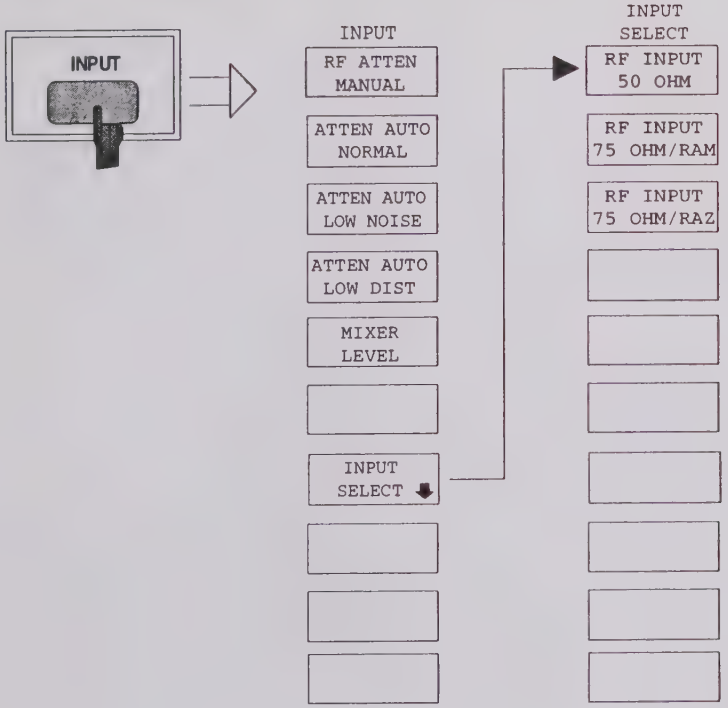


SPAN, START and STOP are without function in the vector analyzer mode!

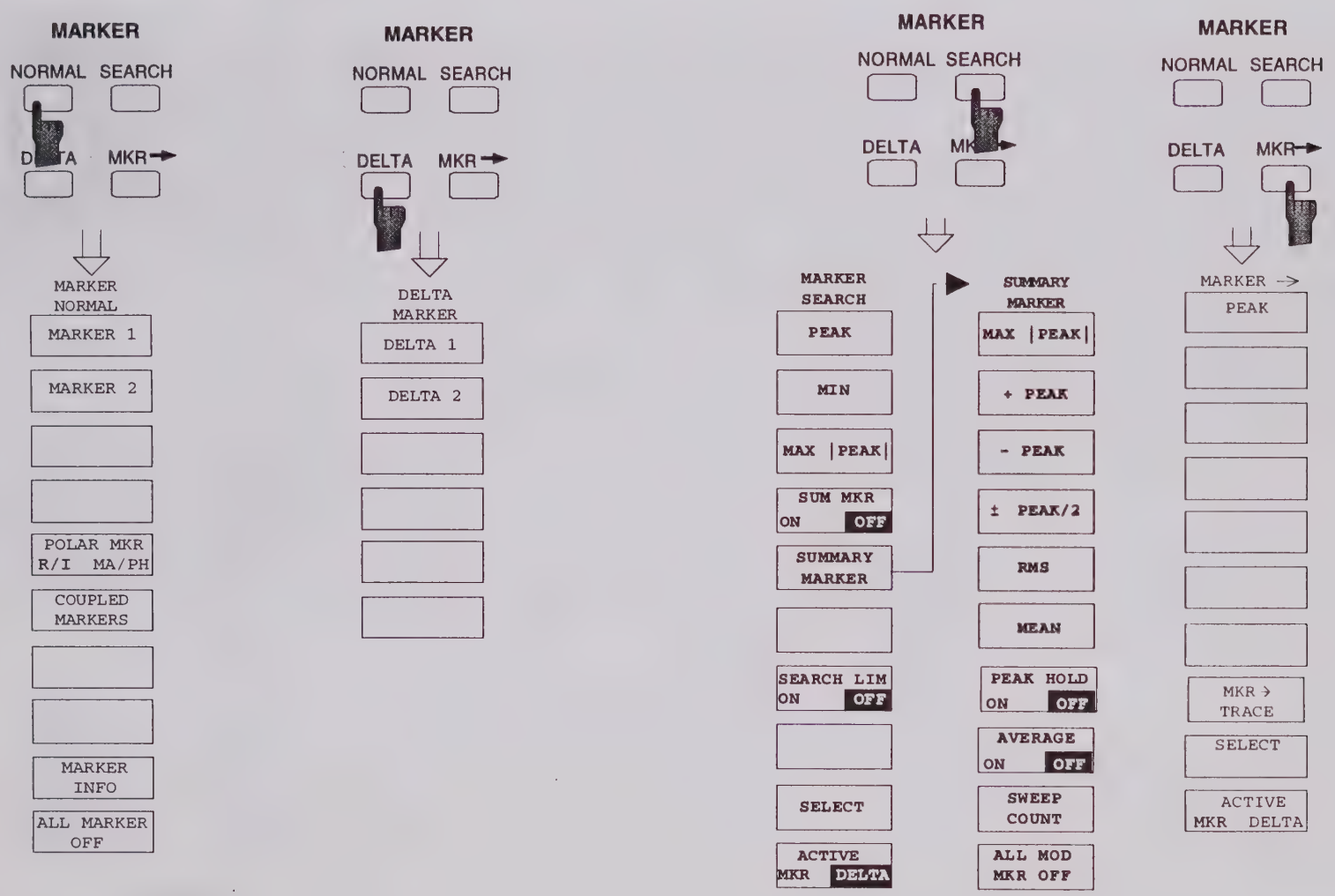
2.2.5 LEVEL Key Group, INPUT Key



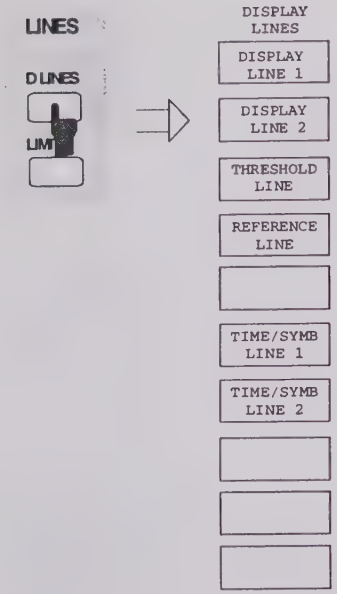


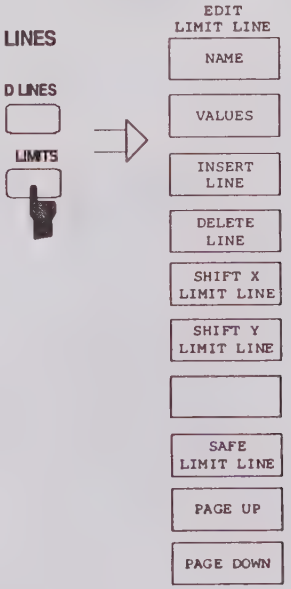

INPUT
INPUT
RF ATTEN MANUAL
ATTEN AUTO NORMAL
ATTEN AUTO LOW NOISE
ATTEN AUTO LOW DIST
MIXER LEVEL
INPUT SELECT
INPUT SELECT
RF INPUT 50 OHM
RF INPUT 75 OHM/RAM
RF INPUT 75 OHM/RAZ

2.2.6 MARKER Key Group

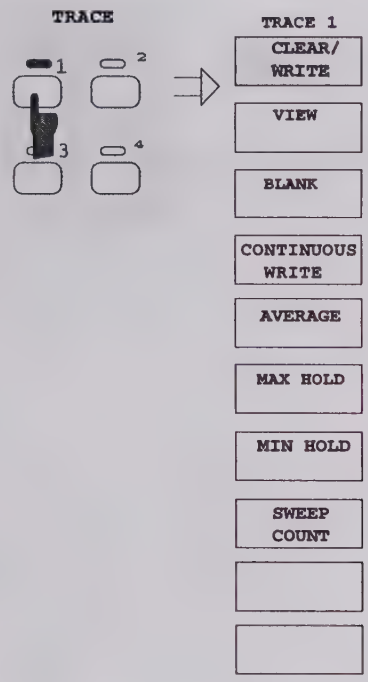


2.2.7 LINES Key Group

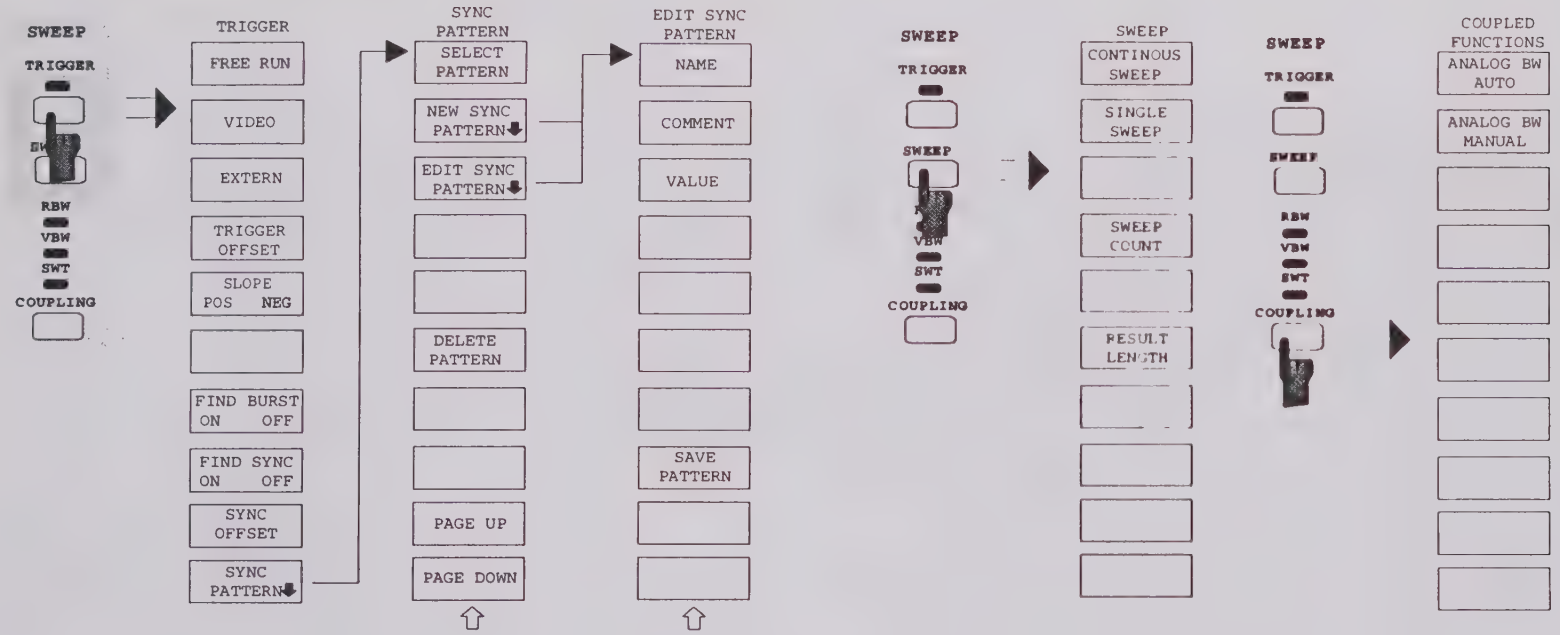




2.2.8 TRACE Key Group



2.2.9 SWEEP Key Group



2.2.10 MEMORY Key Group

See analyzer mode

2.2.11 USER Key Group

See analyzer mode

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2.4 Vector Analyzer Mode

Option Vector Signal Analyzer in FSE allows the analysis of analog and digital modulations. For this purpose, FSE samples the IF signal which is band-limited by the resolution bandwidth (RBW) and mixes it into the complex baseband. The real and imaginary section of the signal is then digitally filtered and further processed in digital signal processors. The complex baseband contains the whole signal information which can be evaluated according to the different criteria.

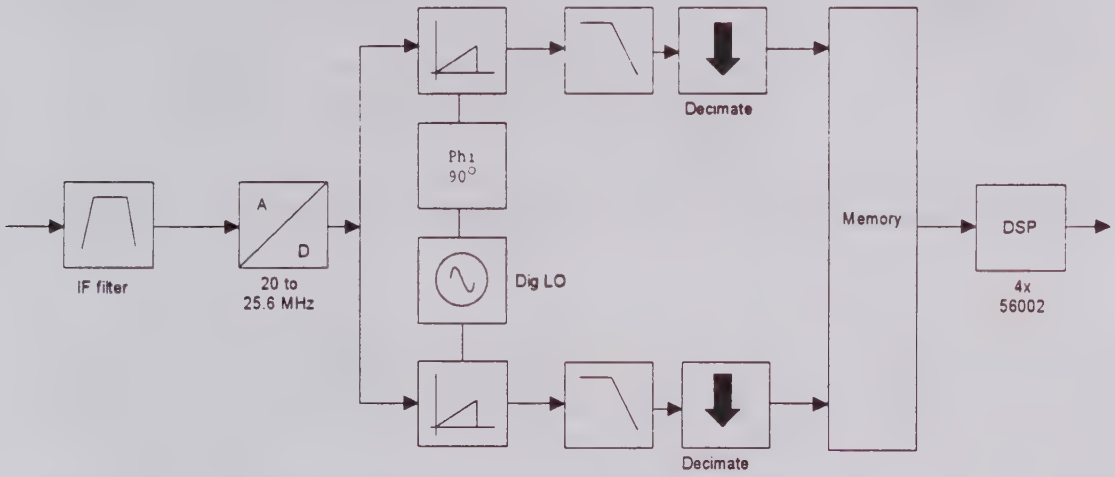


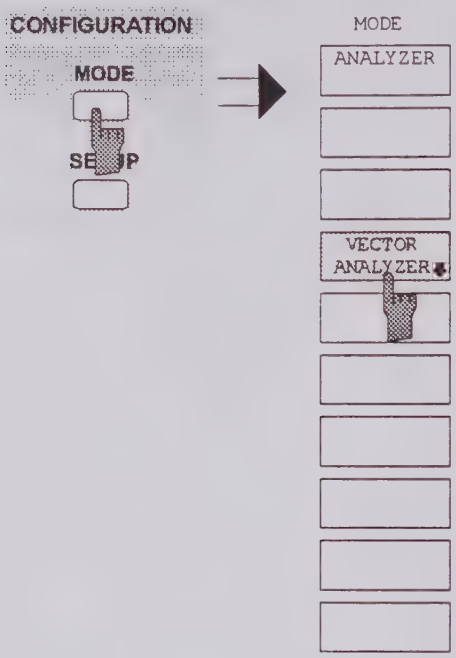
Fig. 2.4-1 Block diagram of FSE vector signal analyzer

Two types of analysis are distinguished in the vector signal analyzer:

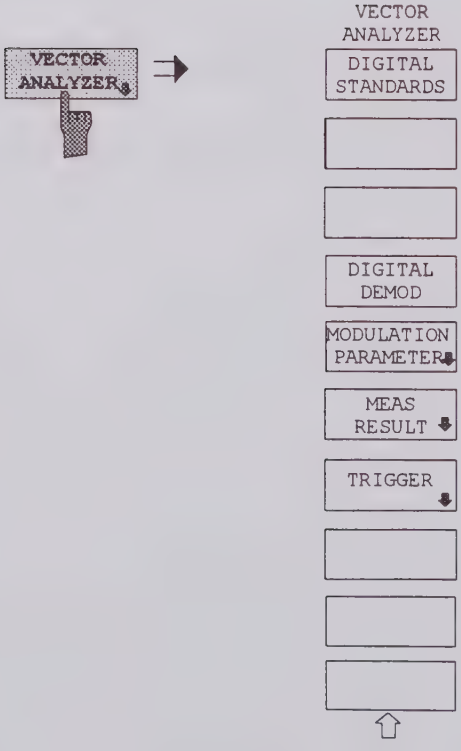
- For digitally modulated signals, commonly used demodulators are available to evaluate the modulation parameters.
- In the *DIGITAL DEMODULATION* mode, the magnitude of the non-demodulated signal can also be displayed (MAGNITUDE CAP BUFFER).

2.4.1 Selecting the Operating Mode

The vector analyzer mode is activated as follows:



The *MODE* key calls up the menu for selecting the operating mode.



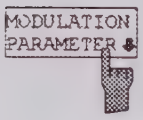
The *VECTOR ANALYZER* softkey calls up a submenu. The specific settings for the vector analyzer are entered into this submenu. The menus for the test parameter settings lying below these keys (*FREQUENCY, LEVEL, MARKER, TRACE, COUPLING, TRIGGER*) are adapted to the specific capabilities of the vector signal analyzer.

Softkeys *DIGITAL DEMOD* and DIGITAL STANDARDS are selectors with which the required type of analysis is set.

Note: *If two displays (screen A and screen B) are opened after switch-on of the vector signal analysis, the vector analyzer mode is only set for the display activated for entry (marked at the top right corner of diagram). For the other display, the previous settings remain valid. Storage and display of measured values is sequential: first in the upper and then in the lower display.*

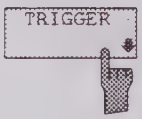
The configuration of the vector analysis is performed in four steps:

1. Setting the type of analysis: general demodulation of digitally modulated signals (*DIGITAL DEMOD)* or setting as required by a specific transmission mode (*DIGITAL STANDARDS*).
2. Selecting the modulation parameters (*MODULATION PARAMETER*).
3. Selecting the required measurement results (*MEAS RESULT).*



The *MODULATION PARAMETER* softkey sets the required modulation parameters for the demodulation of digitally modulated signals.

The MEAS RESULT softkey calls up a submenu in which the required evaluation in the selected type of analysis is set. For DIGITAL DEMODULATION, for example, this is the evaluation of the signal itself or of the reference signal, I/Q or vector errors etc.



see Capter 2.4.10

2.4.3 Digital Modulation Methods

In modern mobile radio networks digital transmission methods are used to avoid the disadvantages of a transmission channel in mobile communication and to be able to serve more subscribers in the available frequency spectrum. FSE offers all commonly used demodulators for digitally modulated signals. All modulation parameters for standard transmission methods can be loaded as required by the user. FSE determines all relevant modulation parameters such as frequency, phase, amplitude and vector errors, etc. Measurements are carried out on continuous as well as pulsed signals such as TDMA signals. Bit patterns can be defined to be able to trigger to known bit sequences like preambles or midambles. The demodulator requires neither a coherent carrier nor a symbol clock for demodulation. It comprises matched filters and synchronizes automatically to the carrier and to the symbol clock. Furthermore, the demodulator can generate the ideal I/Q signal from the demodulated bit stream and thus determine the errors of the analyzed signal.

For a correct demodulation of digital signals, a number of modulation parameters in addition to the modulation mode has to be specified for the signal to be analyzed. The most important are the symbol rate and the input filter. And in addition, the frequency of the FSE (approx. 2% of the symbol rate) has to be tuned exactly to the frequency of the signal to be analyzed.

The bandwidth for demodulation is a function of the symbol rate and the selected oversampling method (POINTS PER SYMBOL). At least 4-fold oversampling is performed. If the number set under POINTS PER SYMBOLis reduced, fewer points are used in the display. The demodulation bandwidth for 1, 2 and 4 points per symbol is 3.125 times the symbol rate, with 8 points per symbol 6.5 times and for 16 points per symbol 13 times. It should be ensured that no modulation spectrum of adjacent signals is within the displayed range during demodulation, as this may introduce errors in the measurement of modulation parameters. If required, check for correct settings in the analyzer mode. The block diagram below shows the digital demodulator and its measurement capabilities:

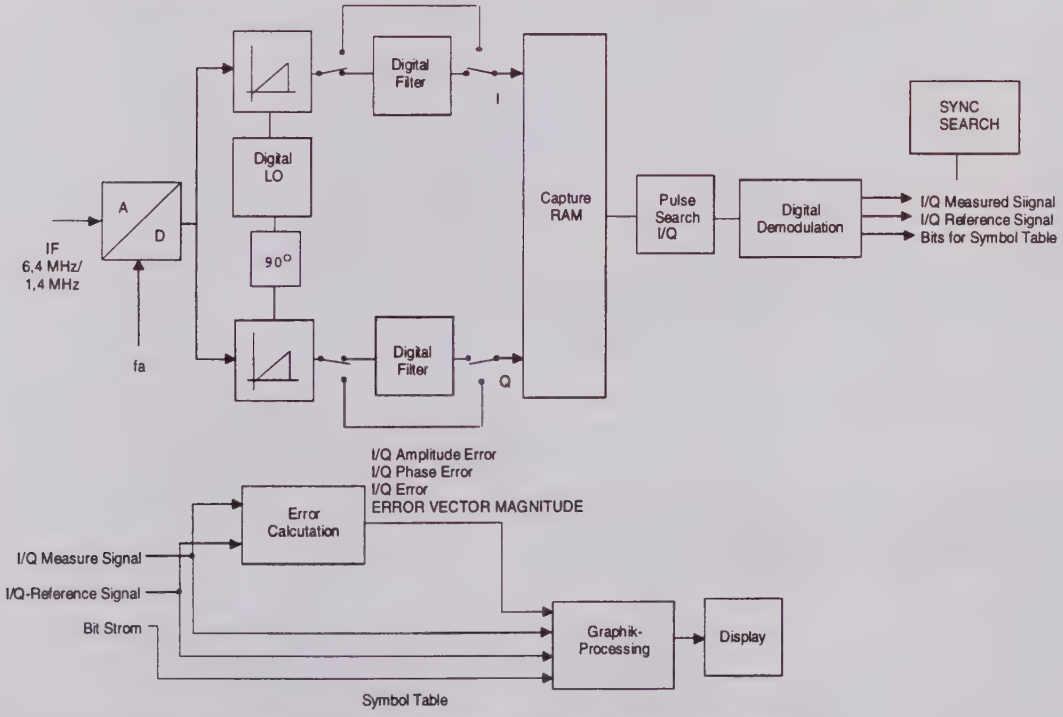


Fig. 2.4-4 Block diagram for signal processing during digital demodulation

The chart below shows demodulator setting menus and pertaining modulation parameters.

Submenu: *CONFIGURATION MODE - VECTOR ANALYZER*

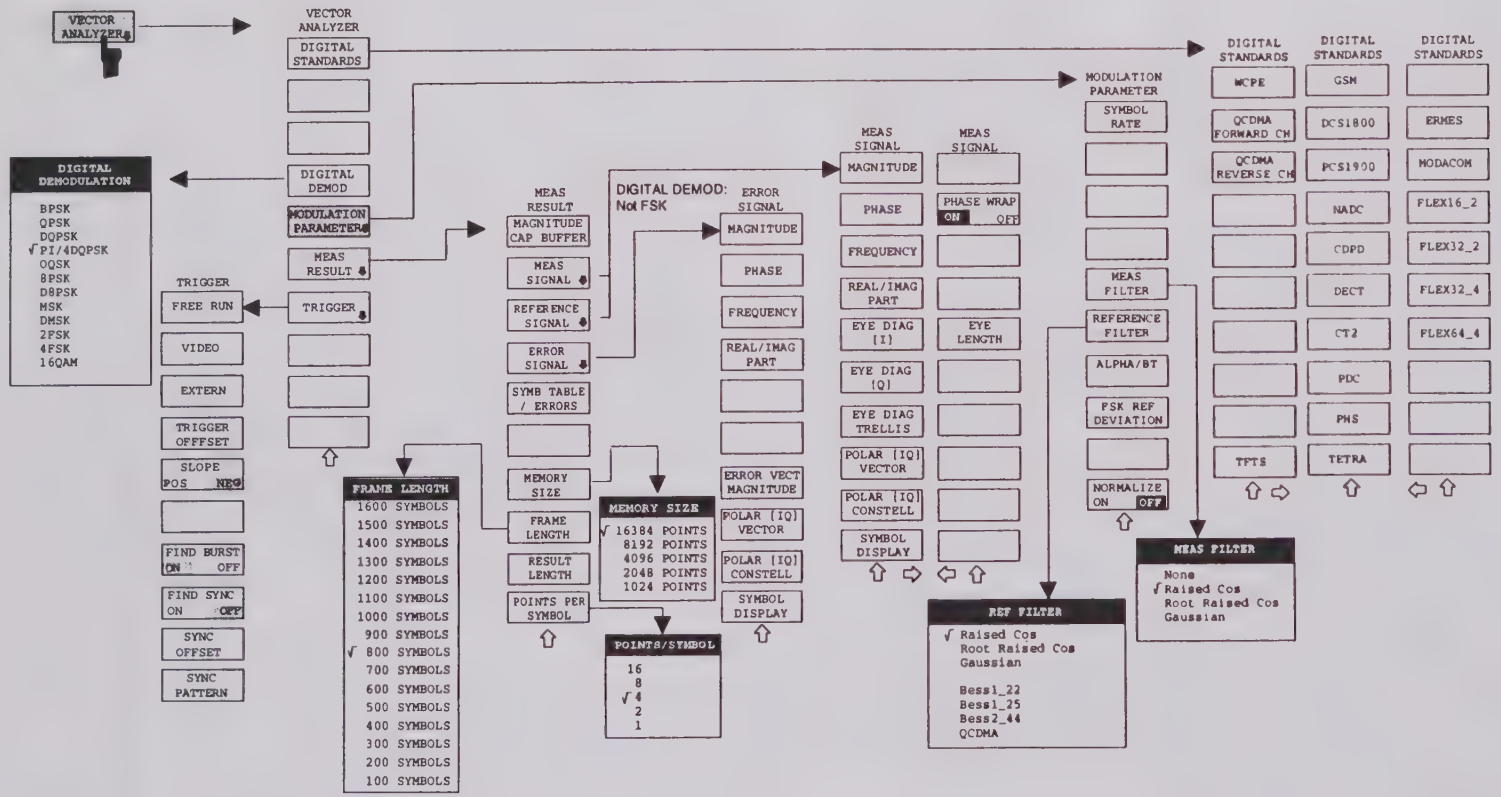
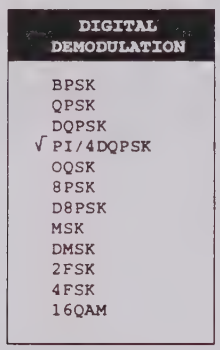


Fig. 2.4-6 Menus for setting the modulation parameters

2.4.3.1 Selecting the Digital Demodulators

Submenu: *CONFIGURATION MODE - VECTOR ANALYZER*

Pressing the *DIGITAL DEMOD* softkey causes a list of all available demodulators to be displayed.



Demodulators are provided for the two-, four- and eight-level phase modulation modes BPSK, QPSK and 8PSK. For QPSK and 8PSK demodulation, the demodulators for differential signals DQPSK and D8PSK can be selected additionally.

Demodulators are also availabe for the special versions of QPSK modulation, such as differential QPSK with $\pi/4$ phase offset ($\pi/4$-DQPSK) and offset QPSK (OQPSK).

QPSK is used, for instance, by the Qualcomm CDMA for modulating signals from the base station to the mobile, OQPSK for signals from the mobile to the base station. The American TDMA system NADC (IS54) uses $\pi/4$-DQPSK for digital signal transmissions.

For higher-level modulation modes the demodulator for 16QAM is available. MSK (minimum shift keying) demodulators pertain to the group of continuous-phase demodulators. MSK with Gaussian filters (GMSK = Gaussian minimum shift keying) is used for the European mobile radio systems GSM and DCS1800 or PCS1900 in the USA. For correct bit detection for GSM, DCS 1800 and PCS 1900 and 1800 the MSK demodulator with additional differential decoding (DMSK) should be activated.

For FSK (frequency shift keying) modulation, two-level (2FSK) and four-level (4FSK) demodulators can be selected.

2FSK modulation methods are used for instance for the digital cordless telephone to DECT standard, 4FSK for the paging system to ERMES standard.

2.4.3.2 Standard Settings

To simplify the selection of parameters when standard transmission methods are used, standard setups are available in the FSE. All modulation parameters are set automatically.

The list below shows available standards and respective settings.
For the GSM, DCS1800 and PCS 1900 standards the sync pattern GSM_BTS0 with the associated synchronization offset of 61 symbols is preset in addition. When selecting the NADC standard, the instrument is set to the burst of the base station with a slot length of 162 symbols. For the burst of the mobile station, the result length has to be reduced to 156 symbols after selection of the NADC standard according to the shorter slot length. In this case the sync offset is 8 symbols.
For the DECT standard the sync pattern of the fixed part DECT_FP is preset, the sync offset is set to 0.
When selecting the TETRA standard, the sync pattern Tetra_1 is preset, the sync offet is preset to 122.

Sync pattern and sync offset become active be switching SYNC SEARCH on.

Note: *The pager standards ERMES and FLEX (2FSK and 4FSK modulation) feature modulation filters with increased bandwidth (B*T> 1). This means that with normal oversampling (4 points per symbol) there is an intolerable bandwidth restriction which causes a distinctly higher demodulation error probability. Therefore the number of points per symbol is preset to 8 when the ERMES standard is selected and to 16 when the FLEX standard is selected.*

Attention: *In case of departures from the preset value (which may happen automatically when increasing the FRAME LENGTH or RESULT LENGTH) there is a higher system error probabiity.*

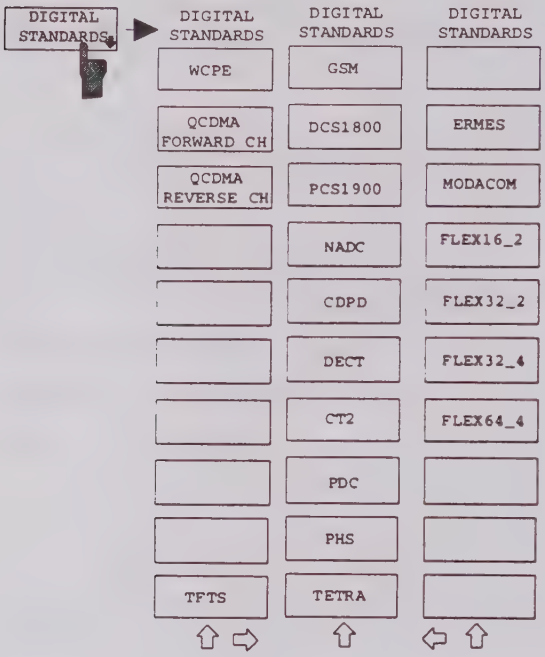
Table 2.4-1 Standard setups

Modulation/ Standard	Symbol rate	Filter Measurement filter	Reference filter	Alpha BT	Synchro-nization	Sync Pattern	SYNC OFFSET	Points/ symbol
GSM, (DCS1800, PCS 1900) MSK	270.833 kHz	NONE	GAUSSIAN	0,3	PULSE SEARCH	GSM_BTS0	61	4
NADC*) π/4 DQPSK	24.3 kHz	ROOT RAISED COS	RAISED COS	0,35	SYNC SEARCH	NADC_S1	0	4
PDC π/4 DQPSK	21 kHz	ROOT RAISED COS	RAISED COS	0,5	PULSE SEARCH	PDC_S1	57	4
PHS π/4 DQPSK	192 kHz	ROOT RAISED COS	RAISED COS	0,5	PULSE SEARCH	PHS_DO1	32	4
CDPD MSK	19.2 kHz	NONE	GAUSSIAN	0,5	–	–	–	4
DECT 2-FSK	1152 kHz	NONE	GAUSSIAN	0,5	VIDEO TRIGGER + PULSE SEARCH	DECT_FP	0	4
TETRA π/4-DQPSK	18 kHz	ROOT RAISED COS	RAISED COS	0,35	PULSE SEARCH	TETRA_1	122	4
CT2 2-FSK	72 kHz	NONE	GAUSSIAN	0,5	PULSE SEARCH	CT2_CFP	0	4
ERMES 4-FSK	3.125 kHz	NONE	BESSEL 1_25		–	–	–	8
MODACOM 4-FSK	4.8 kHz	ROOT RAISED COS	RAISED COS	0,2	–	–	–	4
FLEX 16_2 (FLEX 1600) 2-FSK	1.6 kHz	NONE	BESSEL 2_44	–	–	–	–	16
FLEX 32_2 (FLEX 3200) 2-FSK	3.2 kHz	NONE	BESSEL 1_22	–	–	–	–	16
FLEX 32_4 (FLEX 3200 4-FSK	1.6 kHz	NONE	BESSEL 2_44	–	–	–	–	16
FLEX 64_4 (FLEX 6400) 4-FSK	3.2 kHz	NONE	BESSEL 1_22		–	–	–	16
WCPE π/4 DQPSK	562.5 kHz	ROOT RAISED COS	RAISED COS	0,5	PULSE SEARCH	WCPE_FP1	0	4
QCDMA FORWARD CH QPSK	1.2288 MHz	QCDMA_FM	QCDMA_FR	–	–	–		
QCDMA REVERSE CH OQPSK	1.2288 MHz	QCDMA_RR	QCDMA_RR	–	–	–		
TFTS π/4 DQPSK**)	22.1 kHz	NONE	RAISED COS	0,4	PULSE SEARCH	TFTS_G1	0	

*) The standard setting is matched to the slot of the NADC base station. As the base station doesn't burst, the FIND BURST function is disabled.
In order to measure a mobile station (reverse channel), the result length must be set to 156 symbols, the sync offset to 8 symbols, correspondingly. The find burst function must be switched on for measuring a mobile station!

**) When selecting the TFTS standard, the special bit decoding is made according to the TFTS standard.

Submenu: *CONFIGURATION MODE - VECTOR ANALYZER*



When the *DIGITAL STANDARDS* softkey is pressed, a submenu of available standard setups is displayed.

If one of the following modulation parameters is modified, any DIGITAL STANDARD that may be selected is switched off automatically:

- Symbol rate
- Measurement filter
- Reference filter
- α/BT

2.4.3.3 Selecting Modulation Parameters for Digital Demodulation

Submenu: *CONFIGURATION MODE - VECTOR ANALYZER - MODULATION PARAMETER*

The *SYMBOL RATE* softkey opens a window for entering the symbol rate of the digitally modulated signal to be measured.

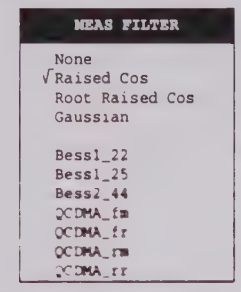
The symbol rate is a function of the bit rate determined via the modulation level and corresponds to the baud rate. With QPSK, for instance, the symbol rate corresponds to half the bit rate (= 2 bits per symbol). Symbols are only valid while the signal is evaluated by the receiver. The time of demodulation is the point of decision. The demodulator of the FSE uses the set symbol rate to find the points of decision.

To be able to select the correct symbols, the symbol rate has to be entered exactly. The more complex (high-level) the modulation method, the more critical the exact definition of the symbol rate. An inaccurately defined symbol rate causes demodulation errors. The settings below should also be observed for selecting the symbol rate:

- Maximum permissible symbol rate is 2 MHz.
- The number of points per symbol is limited to 8 for symbol rates >200 kHz and to 4 for symbol rates >400 kHz.

MEAS FILTER

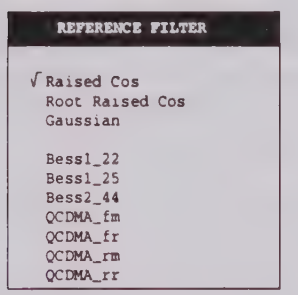
The *MEAS FILTER* softkey selects the input filter for the signal to be measured. The required filter is selected in a table:



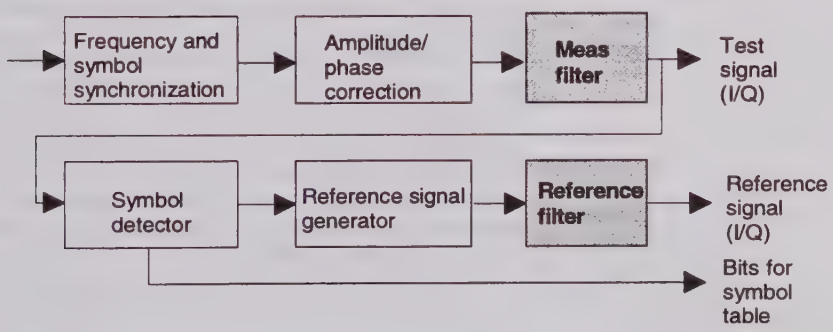
Further information is given in the description of the *REFERENCE FILTER* softkey.

REFERENCE FILTER

The *REFERENCE FILTER* softkey selects the filter for the ideal reference signal for detecting modulation errors at the baseband level. The required filter is selected in a table:



Predefined filters are the squarewave filter (NONE, not permissible as reference filter), the raised cosine filter, the root raised cosine filter and the Gaussian filter. Cosine filters are generally used for phase modulation, Gaussian filters by MSK and FSK modulators.The digital demodulator of FSE generates two signals at the I/Q level, the signal to be measured (*MEAS SIGNAL*) and the reference signal (*REFERENCE SIGNAL*).



The signal to be measured is present at the RF input after demodulation. The reference signal is the signal that would be obtained in the case of an ideal RF signal. A separate filter is provided for the signal and the reference signal.

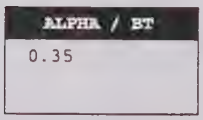
For digital transmissions, filtering can be carried out at the transmitter or receiver end or be split up between both. The filter at the receiver is the measurement filter. The reference filter is used for the total system. Depending on the configuration of filters, the following combinations can be used:

Filters of transmission system		Filters to be selected	
Transmitter	Receiver	MEAS FILTER	REFERENCE FILTER
Root-raised cos	Root-raised cos	Root-raised cos	Raised cos
Raised Cos	none	none	Raised cos
Gaussian	none	none	Gaussian

If no modulation filter is provided in the transmitter, it may also be useful to employ a RAISED COS or GAUSSIAN filter as measurement filter. However, the non-existing band limiting at the FSE input may cause unwanted aliasing products in the vector analyzer mode, which might impair the measurement. A measurement without reference filter is not possible!

If an input filter is used for demodulation or a filter for generating the reference signal, the filter characteristic has to be determined by means of *ALPHA/BT*. With Nyquist filters *ALPHA* has to be specified, with Gaussian filters the product of the symbol period T and bandwidth B (*BT*).

Pressing the A*LPHA/BT* softkey opens a window where the roll-off factor (*ALPHA*) for the cosine filters or the bandwidth/symbol period product *BT* for the Gaussian filters is entered. All filters are computed up to a length of 16 symbols.



Permissible input values are 0.2 to 3 in steps of 0.05. The value for *ALPHA/BT* applies to the measurement and to the reference filter. Values for *ALPHA* or *BT* are determined by the digital transmission system. These values should be used for measurements with FSE as higher demodulation errors could otherwise occur.

For ALPHA/BT >1, the demodulation bandwidth with sampling of 4 points per symbol is usually not sufficient. In this case it is recommended to set the number of points per symbol to 8 or 16. See also the note under DIGITAL STANDARDS. *ALPHA* describes the transmission characteristic of a Nyquist filter (cosine filter). It is also designated as roll-off factor or bandwidth factor. The greater ALPHA, the greater is the bandwidth occupied by the digitally modulated signal relatives to the theoretical minimum. In digital transmission systems typical bandwidth factors of 0.25 to 0.5 are used, ie the occupied bandwidth is 25% to 50% larger than the theoretical minimum. The bandwidth/time product *BT* describes the characteristic or the bandwidth factor of Gaussian filters.

After pressing the FSK REF DEVIATION softkey, the reference deviation for FSK demodulation can be entered.

The reference deviation is required for calculating the deviation error.

FSK REF DEVIATION

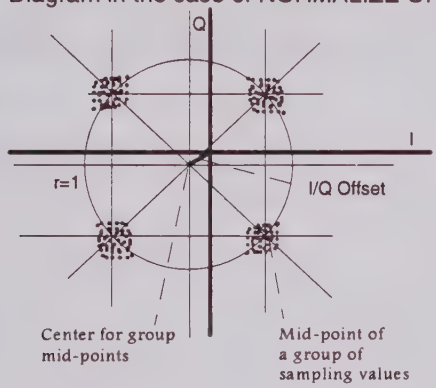
After pressing the *FSK REF DEVIATION* softkey, the reference deviation for FSK demodulation can be entered.
FSK deviation is defined as the (unilateral) deviation from the center frequency occurring in the case of modulation with constant 0 or 1 sequences, ie the stationary value.
With 4FSK, the modulation deviation is the deviation from the center frequency with the bit sequences causing maximum frequency deviation.
The reference deviation is used for computing the deviation error in NORMALIZE ON mode.

NORMALIZE ON OFF

Pressing the *NORMALIZE ON/OFF* softkey has the following effect:
The measurement result in the vector and constellation diagram is always normalized to a circle, the radius of which corresponds to the mean distance between the center of the circle and the mid-points (of all groups of sampling values).

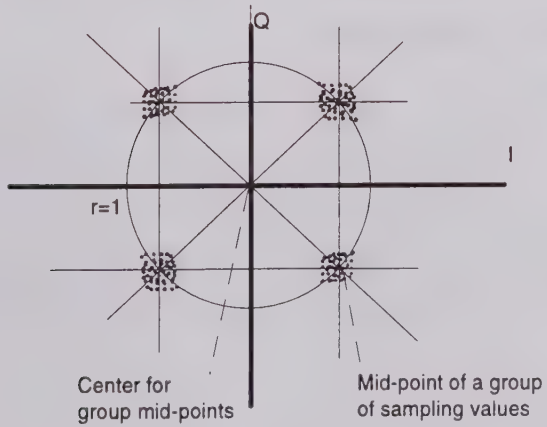
This circle is defined as a unit circle with the radius 1.Softkey *NORMALIZE ON* shifts the center of the unit circle by the I/Q offset to the center for the group mid-points:

Diagram in the case of NORMALIZE OFF:



Default state is NORMALIZE ON:

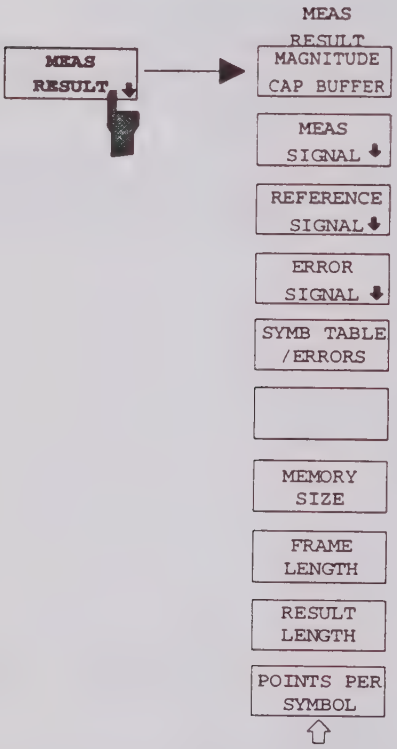
The center of the unit circle is shifted by the I/Q offset to the center for the group mid-points:



2.4.3.4 Selecting Measurement Results for Digital Demodulation

After entering all modulation parameters the required measurement is selected using the *MEAS RESULT* softkey. The contents of the trace memory (magnitude), the demodulated measurement signal, the reference signal, ie the ideal signal derived from the measurement signal, or the error signal can be displayed as the measurement result. The I/Q error and the vector error are the two possible error signals. A table is available listing all errors together with the demodulated bits.

Submenu: *CONFIGURATION MODE - VECTOR ANALYZER - MEAS RESULT:*



The *MEAS RESULT* softkey opens a submenu in which the different displays for the measured signal can be selected.

The *MAGNITUDE CAP BUFFER*, *MEAS SIGNAL*, *REFERENCE SIGNAL*, *ERROR SIGNAL* and *SYMB TABLE/ERRORS* softkeys are selection switches, ie only one of the measurement results offered can be selected per screen. If two screens are available, (split-screen mode) a different measurement result can be displayed in each screen.

When the measurement signal, the reference signal and the error signal are displayed, submenus are called up by the corresponding softkeys and the associated parameter can be set.

Moreover, softkeys are available for setting the memory size, the number of bits to be demodulated and displayed (see section 2.4.3.5).

2.4.3.4.1 Magnitude of Capture Buffer

The capture buffer is the memory comprising the samples that are entered during the storage of measured values. These samples are used for demodulation but are retained over the complete measurement. A reason for this is the loss in the dynamic range during the synchronization and demodulation of the signal. For synchronization, an interpolation between the samples is necessary, for example, for determining the symbol decision point accurately. Interpolation is always synonymous with a loss in the amplitude dynamic range. In case of synchronization, the signal has to be normalized. The normalization is also linked with a loss in the dynamic range.
When measuring the power ramping of a TDMA burst, a maximum dynamic range is required. This dynamic range is obtained when using the capture buffer for samples.

When the *MAGNITUDE CAP BUFFER* softkey is pressed, the magnitude of the signal in the capture buffer is indicated in the time domain.

The *MAGNITUDE CAP BUFFER* mode is therefore recommended in all cases where power ramping of TDMA bursts should be measured with a wide dynamic range. Timing will be accurate to less than or equal to half a clock period of the sampling unit

Example:
A signal is sampled with 8 values per symbol. The maximum timing error of the TDMA burst synchronized to a bit sequence is 1/16, ie 6.25% of the symbol period.

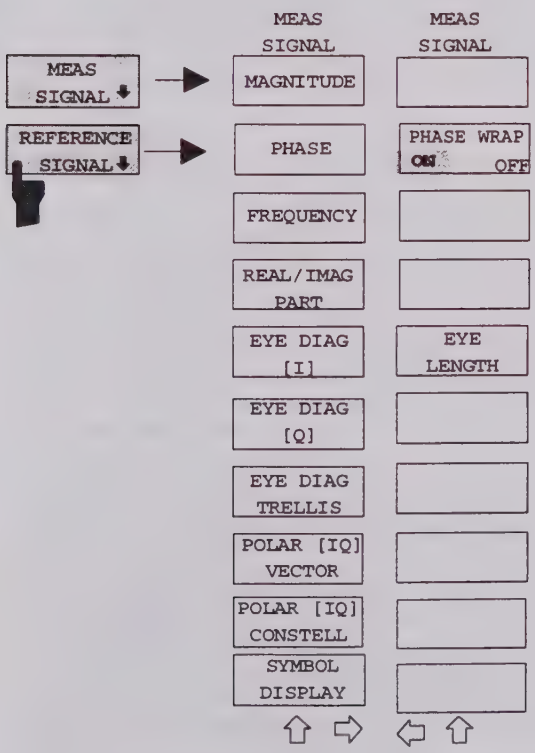
2.4.3.4.2 Measurement or Reference Signal

FSE can display both the waveform of the measurement signal, which is derived from the samples in the baseband, and that of the reference signal. To this effect, the measurement signal is filtered and synchronized to the carrier and the symbol clock. The I/Q offset and the amplitude reduction of the signal is compensated prior to the display. The reference signal is generated from the demodulated bits by modulation down to the baseband. It is identical to the measurement signal freed of modulation errors and noise.

The output formats for the measurement signal and the reference signal are identical.

The output formats are different for FSK demodulation and all other demodulation modes.

Output formats for non-FSK demodulation:



Identical submenus are opened by the *MEAS SIGNAL* and *REFERENCE SIGNAL* softkeys. The output formats of the two signals can be selected there.

MAGNITUDE

With the *MAGNITUDE* softkey, FSE displays the magnitude of the demodulated measurement or reference signal, which is normalized to 1, as a function of time and symbol.

PHASE

The phase of the measurement or reference signal is displayed by means of the *PHASE* softkey.

PHASE WRAP ON OFF

The phase of a signal can have very high values due to the modulation. Therefore, scaling should be very coarse to display the phase over many bits. FSE therefore offers the phase to be shifted by means of the *PHASE WRAP ON/OFF* softkey. In the *ON* position, FSE displays the phase in the range of ±180°. If the phase exceeds +180°, for example, 360° is subtracted from the phase value so that >-180° is indicated. This avoids very high phase values to be displayed which would impair the reading accuracy. In the *OFF* position, the phase is not shifted. It is displayed within the range of the Y axis. Phase values above or below this range are cut off at the diagram edges.

FREQUENCY

In the *FREQUENCY* setting, the time or symbol-dependent frequency response of the signal is displayed, ie, the frequency-demodulated signal. The softkey is only available for MSK demodulation.

The frequency display is suitable for measuring the frequency deviation by using the markers.

REAL/IMAG PART

The *REAL/IMAG PART* calls up the display of the real and imaginary parts of the measurement or reference signal in separate diagrams. To this effect, the diagram is split up. The real part is displayed in the upper half whereas the imaginary part is displayed in the bottom half. The X axis (which is scaled in time units or symbols) is identical for the two diagrams.

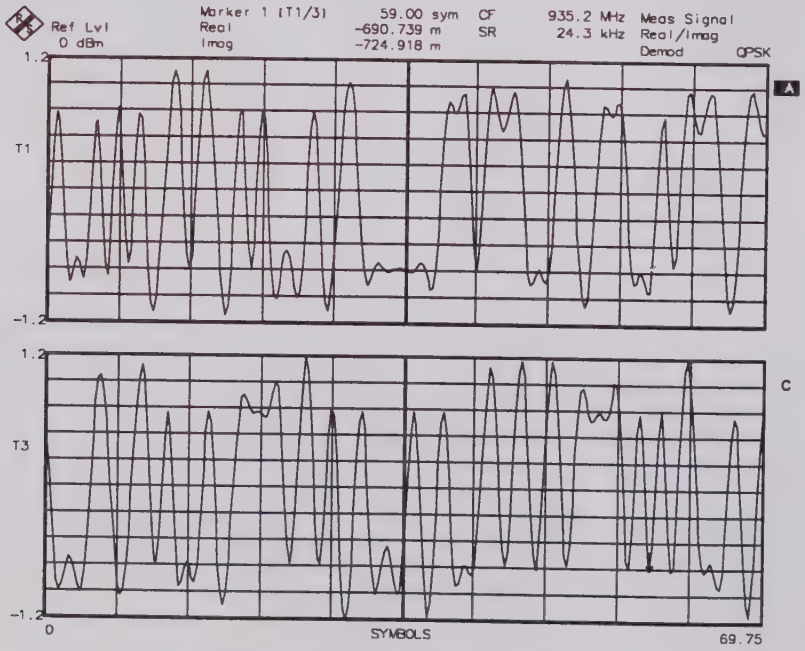


Fig. 2.4-6 Simultaneous display of inphase and quadrature component in a single diagram (here: screen A in split-screen display)

The various eye diagrams are selected by means of the *EYE DIAG [I]*, *EYE DIAG [Q]* and *EYE DIAG TRELLIS* softkeys :

- eye diagram for the inphase signal,
- eye diagram for the quadrature signal and
- trellis diagram.

The eye diagram is the representation of inphase and quadrature signal (*EYE DIAG [I] or EYE DIAG [Q]*) as a function of time. It is triggered by the symbol clock at the points of decision. The number of states on the time axis is determined by *EYE LENGTH*.

The individual traces of the eye diagram are superimposed on each other until the number of symbols specified with *RESULT LENGTH* is attained. The successive traces are the continuation of the trace written last, ie the total trace is displayed in a folded form. To obtain a complete eye diagram, all the states of a signal have to be traced at least once. The number of eyes corresponds to the number of modulation states less 1. The eye aperture is a measure for differentiating between two decision levels. A small eye apertures indicate a high, large eye apertures a small bit error rate.

The trellis diagram is used for representing the states of continuous-phase modulation methods (eg MSK). It indicates the phase versus time and permits also phases above ±180° to be displayed. The trellis diagram is similar to the eye diagram in that measured traces are superimposed onto each other in the display until the number of symbols defined by *RESULT LENGTH* is attained.

For FSE, the trellis diagram is particularly useful for testing MSK and GMSK modulation. The symbols are spaced by 90°. A phase shift of +90° corresponds to logic 1, a shift of -90° to logic 0. A rising phase edge therefore indicates a logic 1, a falling edge a logic 0. Same as with the eye diagram, the width of the trellis diagram is defined by *EYE LENGTH*. To obtain a clear display, a minimum of 5 symbols should be selected as display width.

The number of P*OINTS PER SYMBOL* should be as high as possible to obtain a continuous trace in the eye diagram. 8 to 16 points are recommended.

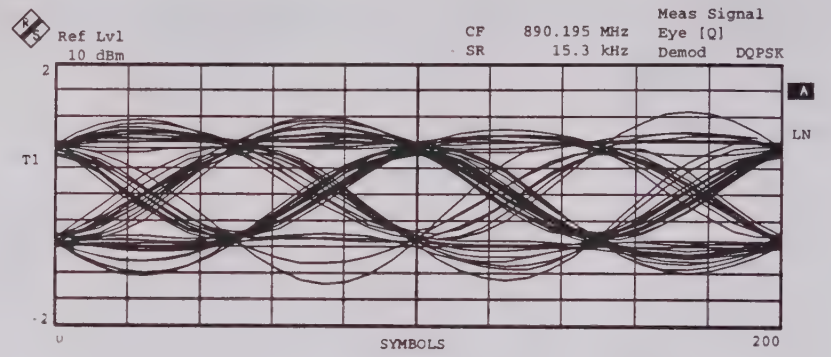


Fig. 2.4-7 Eye diagram over 200 symbols of a DQPSK-modulated signal. Five symbols are displayed.

EYE LENGTH

The *EYE LENGTH* softkey determines the display width of the eye diagram in symbols. The number of symbols is entered in the field.

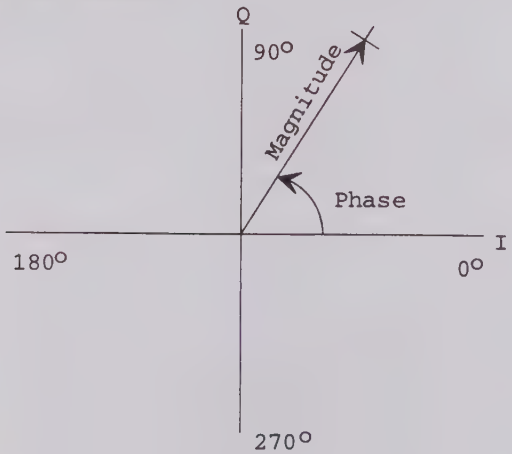
At least one symbol length or two states are required for a complete eye. To be able to detect the errors particularly at the zero crossings, two to five symbols are recommended. The number of symbols is limited with *RESULT LENGTH*. In the case of *EYE LENGTH = RESULT LENGTH*, however, the signal versus time is displayed, the eyes are no longer visible.

POLAR [IQ] VECTOR

When t*he POLAR [IQ] VECTOR and POLAR [IQ] CONSTELL* softkey is pressed, the trace is displayed in the form of a polar diagram. In the vector diagram, all the points are marked. In the constellation diagram only those at the points of decision.

POLAR [IQ] CONSTELL

In the I/Q diagram, FSE displays the inphase component of the signal on the X axis, the quadrature component on the Y axis. Each trace represents a vector. The magnitude of the vector is the distance to the zero point, the phase is the angle between the positive X axis and the vector measured counterclockwise.



$$\text{Magnitude} = \sqrt{I^2 + Q^2}$$

In the vector diagram the number of points between the points of decision is determined with *POINTS PER SYMBOL*. For instance, if 5 points per symbol have been selected, every 5th point is a symbol at the point of decision. The other four points are intermediate values. The points of decision can be marked by selecting *Dots* under *SYMBOL DISPLAY*.

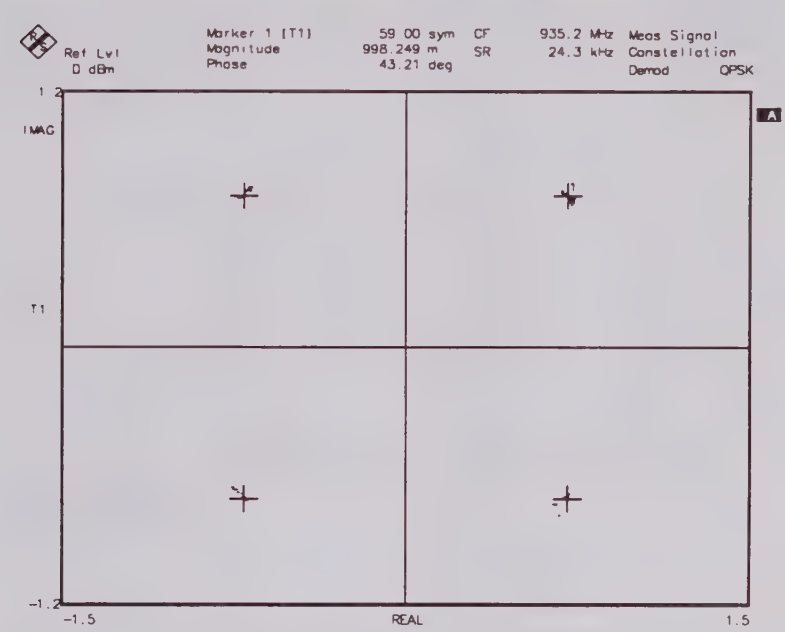


Fig. 2.4-8 Constellation diagram (example QPSK)

SYMBOL DISPLAY

The *SYMBOL DISPLAY* softkey marks the symbol decision points in the displayed trace. The desired form of highlighting can be selected from the table. Points of decision can be marked by vertical lines or by means of dots.

SYMBOL DISPLAY
off
Dots
√ Lines

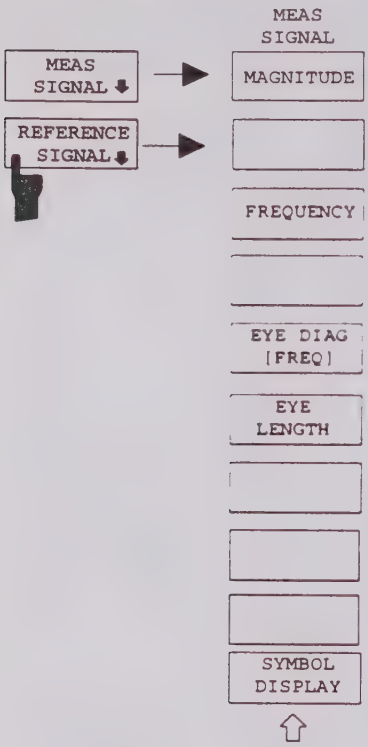
With *off* selected, the points of decision are not marked. When *Dots* are selected, points are drawn on the trace and for *Lines*, (except for vector and constellation diagrams) vertical lines are drawn between the X axis and the trace.

For vector and constellation diagrams dots are inserted with *Dots* **and** *Lines*.

For the constellation diagram dots are also displayed even in the *off* mode.

This function is used for displaying the time characteristic of measurement results, eg as an I/Q characteristic or error signal.

Output formats with FSK demodulation:



With the *MAGNITUDE* softkey, FSE displays the magnitude of the demodulated measurement or reference signal as a function of time and symbol.

In the *FREQUENCY* setting, the time- or symbol-dependent frequency response of the signal is displayed, ie the frequency-demodulated signal.

The frequency display is for instance suitable for measuring the frequency deviation by using the markers.

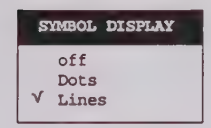
The eye diagram is the representation of the frequency-demodulated signal as a function of time. This signal is triggered by the symbol clock at the points of decision. The number of states on the time axis is determined by *EYE LENGTH*.

The individual traces of the eye diagram are superimposed on each other until the number of symbols specified with *RESULT LENGTH* is attained. The successive traces are the continuation of the trace written last, ie the total trace is displayed in a folded form. To obtain a complete eye diagram, all the states of a signal have to be traced at least once. The number of eyes corresponds to the number of modulation states less 1. The eye aperture is a measure for differentiating between two decision levels. A small eye apertures indicate a high, large eye apertures a small bit error rate.

The *EYE LENGTH* softkey determines the display width of the eye diagram in symbols. The number of symbols is entered in the field.

At least one symbol length or two states are required for a complete eye. Two to five symbols are recommended however to detect the errors particularly at the zero crossings. The number of symbols is limited by *RESULT LENGTH*. In the case of *EYE LENGTH = RESULT LENGTH*, however, the signal versus time is displayed, the eyes are no longer visible.

The *SYMBOL DISPLAY* softkey marks the symbol decision points in the displayed trace. The desired form of highlighting can be selected from the table. Points of decision can be marked by vertical lines or by dots..



With *off* selected, the points of decision are not highlighted. When *Dots* are selected, points are drawn on the trace and with *Lines* selected (except for vector and constellation diagrams), vertical lines are drawn between the X axis and the trace.

2.4.3.4.3 Measurement of Modulation Errors

FSE evaluates the modulation errors by comparing the measurement signal with the internally generated ideal reference signal. The different output formats of the error are selected by means of the *ERROR SIGNAL* softkey.

Non-FSK demodulation:

The modulation error of the measurement signal can be displayed separately, ie according to magnitude and phase, as I and Q error, error vector magnitude or, in polar diagrams, as vector or constellation diagram.

The magnitude and phase error are determined according to the following equations:

$$\text{Error signal magnitude} = \sqrt{I^2 + Q^2} - \sqrt{I_{ref}^2 + Q_{ref}^2} \text{ and}$$

$$\text{Error signal phase} = \arctan\frac{Q}{I} - \arctan\frac{Q_{ref}}{I_{ref}}, \text{ where}$$

the real and imaginary part of the error signal are given as follows

$$\text{Error signal real part} = I - I_{ref} \text{ and}$$

$$\text{Error signal imag part} = Q - Q_{ref}$$

The magnitude of the error vector (error vector magnitude) is

$$EVM = \sqrt{(I - I_{ref})^2 + (Q - Q_{ref})^2}$$

I, Q = measured I/Q component
I_{ref}, Q_{ref} = I/Q components ideally calculated from the bit sequence.

The following vector diagram indicates the different types of errors resulting from the measurement signal and the reference signal:

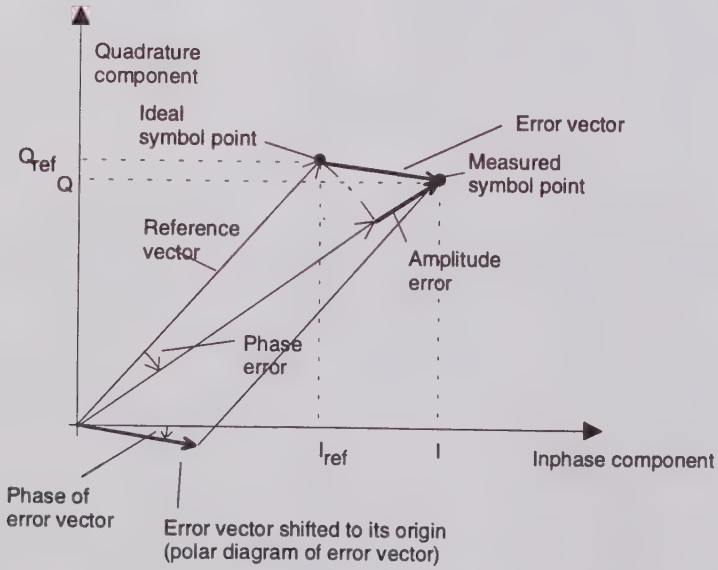
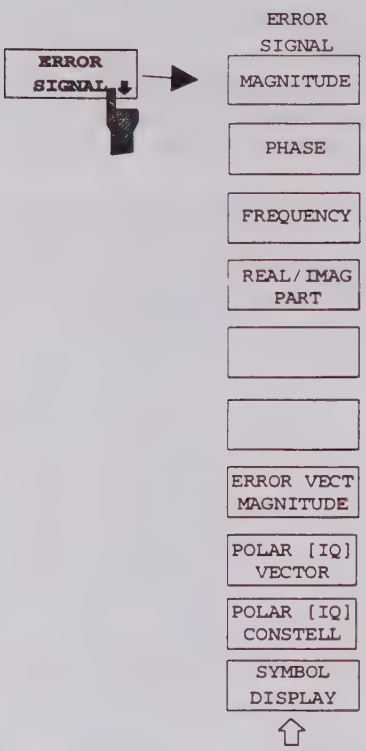


Fig. 2.4-9 Graphic display of modulation errors by means of a point of decision



The *ERROR SIGNAL* softkey opens the submenu for selecting the type of error to be displayed.

With ***MAGNITUDE*** selected, FSE compares, point by point, the magnitude of the measurement signal with the magnitude of the ideal signal. The difference of the two magnitudes is displayed.

With ***PHASE*** selected, FSE compares, point by point, the phase of the measurement signal with the phase of the ideal signal. The difference of the two phases is displayed as phase error.

With ***FREQUENCY*** selected, the frequency error is displayed. The frequency response of the measurement signal is compared with that of the ideal reference signal and the difference between the two responses is displayed as a function of time and symbol. The softkey is only available for MSK demodulation .

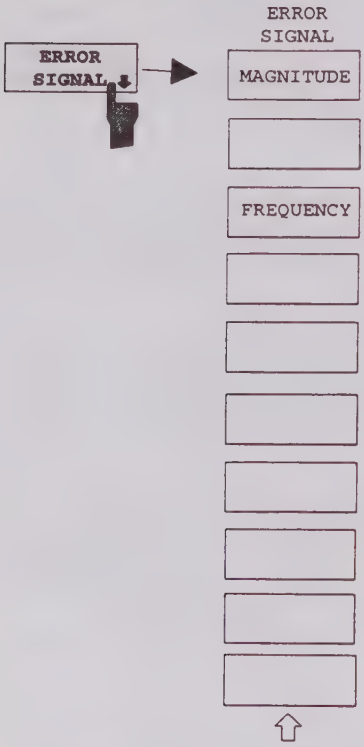
With ***REAL/IMAG PART*** selected, the error of the real and imaginary part is displayed in separate diagrams. To this effect, the measurement diagram is split up. The real part is displayed in the top half and the imaginary part in the bottom half. The X axis (time or symbols) is identical for the two diagrams.

ERROR VECT MAGNITUDE displays the magnitude of the error vector versus time or symbols.

The error vector diagram (***POLAR [IQ] VECTOR)*** and the error constellation diagram (***POLAR [IQ] CONSTELL***) are available for polar representation of the error vector. With these forms of representation, the points of decision are all shifted back to the origin and are laid on top of each other. The errors at the points of decision can thus be seen at a glance.

For error representation, FSE definiert**. compares** all the points of the measurement and reference signal and displays them in the error diagram (except for *POLAR [IQ] CONSTELL*). Thus, the number of measurement results depends on the number of points per symbol. If only the errors are to be evaluated at the points of decision, the number of POINTS PER SYMBOL has to be set to one.
To maintain the correct error for discontinuous transmission, eg for TDMA methods, make sure that only valid symbols are displayed. The *RESULT LENGTH* and the trigger condition have to be set appropriately.

FSK demodulation:



The *ERROR SIGNAL* softkey opens the submenu for selecting the type of error to be displayed.

With ***MAGNITUDE*** selected, FSE compares, point by point, the magnitude of the measurement signal with the magnitude of the ideal signal. The difference of the two magnitudes is displayed.

With ***FREQUENCY*** selected, the frequency error is displayed. The frequency response of the measurement signal is compared with that of the ideal reference signal and the difference between the two responses is displayed as a function of time and symbol.

2.4.3.4.4 Symbol Table and Table of Modulation Errors

The symbol table and the table with modulation errors are indicated in the same display. In this case, the two tables are assigned to a trace. Similar to the trace display, the corresponding trace can be frozen (*VIEW*) or faded out (*BLANK*). If only one window is displayed, the symbol table is assigned to trace 1 and the error table to trace 2.

With the *SYMB TABLE / ERRORS* softkey pressed, a table of demodulated bits and a table of modulation errors of the measured signal is displayed.

The symbol table shows the demodulated bits of the signal. The number of bits is defined under *RESULT LENGTH* in the same menu. Bits can be related to the traces (in split screen mode) by means of the marker coupling. The marker on the trace and the associated symbol are marked at the same time.

The indicated modulation errors differ depending on whether FSK signals are demodulated or one of the other digital demodulators is active.

The following parameters are indicated as sum errors of the modulation:(except with FSK demodulation):

- Frequency error
- Magnitude error
- Phase error
- Error vector magnitude
- I/Q offset
- I/Q imbalance and
- Amplitude droop
- Rho factor .

FSE evaluates these errors within the Result Length or in a range limited by the vertical lines within the Result Length.

- Frequency error
- Magnitude error
- FSK deviation
- FSK deviation error

The entered reference deviation is indicated in addition (FSK REF DEVIATION).

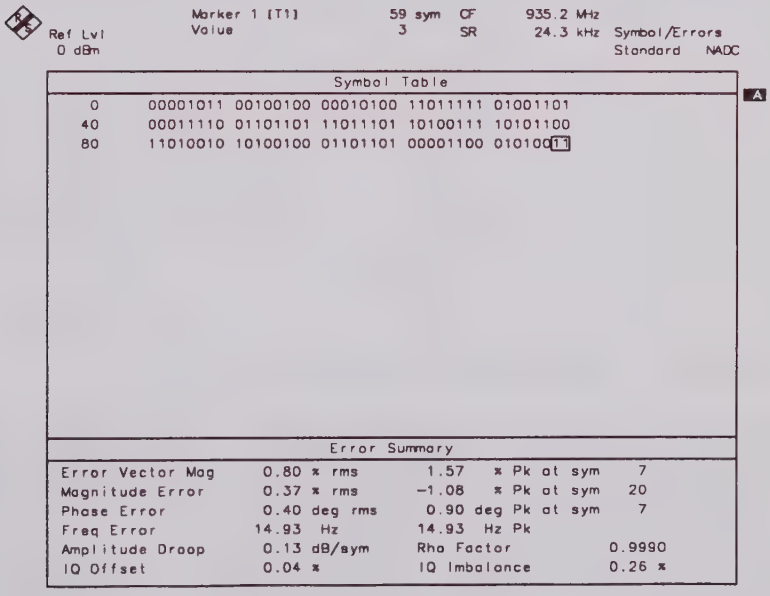

Marker 1 [T1] 59 sym CF 935.2 MHz
Value 3 SR 24.3 kHz Symbol/Errors
Ref Lvl 0 dBm Standard NADC
Symbol Table
0 00001011 00100100 00010100 11011111 01001101
40 00011110 01101101 11011101 10100111 10101100
80 11010010 10100100 01101101 00001100 01010011
A
Error Summary
Error Vector Mag 0.80 % rms 1.57 % Pk at sym 7
Magnitude Error 0.37 % rms -1.08 % Pk at sym 20
Phase Error 0.40 deg rms 0.90 deg Pk at sym 7
Freq Error 14.93 Hz 14.93 Hz Pk
Amplitude Droop 0.13 dB/sym Rho Factor 0.9990
IQ Offset 0.04 % IQ Imbalance 0.26 %

Fig. 2.4-10 Symbol table and table of sum errors (not FSK demodulation)

Description of errors as follows:

Magnitude error :
The magnitude error is the amplitude difference of the I/Q components of measurement signal and reference signal at the points of decision. For MSK modulations, all the points are considered in the calculation. It is a measure for the quality of the amplitude component of the modulated signal.

Phase error :
The phase error is the phase difference of the I/Q components of measurement signal and reference signal at the points of decision. For MSK modulations, all the points are considered in the calculation.

Vector error :
The error vector magnitude is the magnitude of the error vector which links the measured I and Q value in the complex plane to the ideal I and Q value at the points of decision (see Fig. 2.4-8). The error is calculated according to the following equation:

Error vector magnitude (EVM) = $\sqrt{I_{err}^2 + Q_{err}^2}$, where

I_{err} = error of the inphase signal and
Q_{err} = error of the quadrature signal

Frequency error :
The frequency error is the deviation of the FSE centre frequency from the measured carrier frequency. It is derived from the frequency shift to be effected for synchronization to the carrier. The reference error of the FSE is also part of the frequency error.

Amplitude droop :
The amplitude droop indicates the amplitude variation of the signal between the two symbols at the points of decision in dB. This parameter is very important for TDMA signals and is a measure for the quality of pulse modulation.

I/Q offset:
The I/Q offset is a measure for the LO feedthrough with analog I/Q modulators. It can be seen through a shift of the zero point in the constellation diagram. Without LO feedthrough (LO 100 % suppressed), the I/Q offset is zero. It is measured at the points of decision.

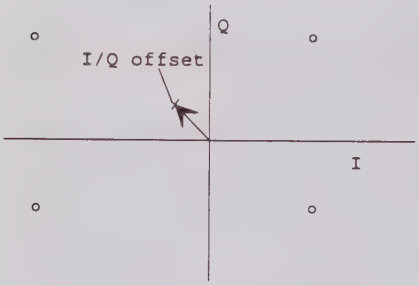
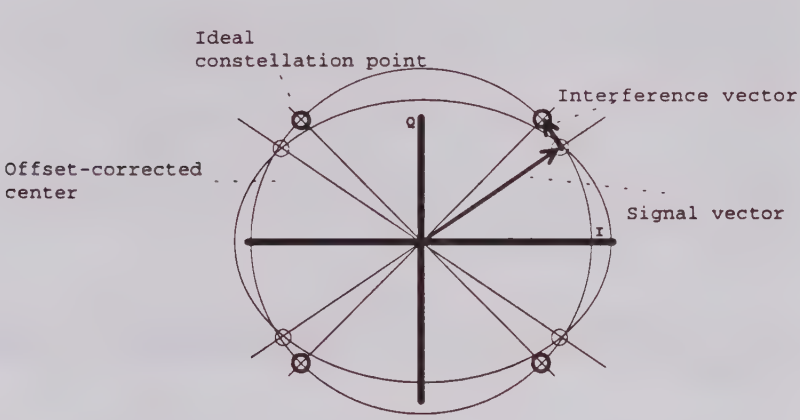


Fig. 2.4-11 Constellation diagram with I/Q offset

Amplitude and vector errors are given in %, phase errors in degrees (deg) or radian (rad). Prior to calculation, the measurement result is normalized in the vector or constellation diagram to a circle around the centre of the group mid-points, the radius corresponding to the mean distance of all group mid-points to the centre. This circle is defined as a unit circle with the radius 1 (see *NORMALIZE* function in the *MODULATION PARAMETER menu*)
Then, the errors at the points of decision are determined and the rms of the individual error values is calculated. Since the constellation diagram is normalized, the result is the rms value of the error in %.

I/Q imbalance:
The I/Q imbalance is a measure for the symmetry of the I/Q modulator to be measured.
The I/Q gain error is the result of unequal gain factors in the I and Q path of the transmitter.
The I/Q imbalance is calculated from the square root of the quotient of the vector magnitude for the wanted and interfering signals averaged over all points of decision:

$$\text{I/Q imbalance} = 100 * \sqrt{\sum_{i=1}^{n} \frac{|\text{Interferencevector}|^2}{|\text{Signal vector}|^2}} \quad [\%]$$



Rho factor:
Similar to the error vector magnitude, the Rho factor is a measure for the quality of digital modulation. It is determined by measurement of the normalized correlated power between the measured signal and reference signal (Qualcomm CDMA to US standard IS-98, Chapter 12.4.2.1) and is designated as waveform quality factor.
The Rho factor can assume a maximum value of 1.0 (measured signal and reference signal are a 100% identical).

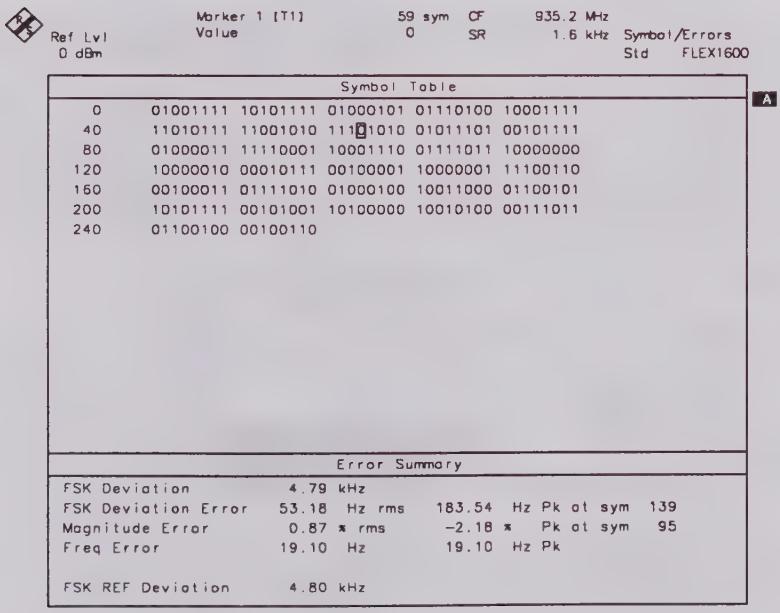


Fig. 2.4-12 Symbol table and table of sum errors (FSK demodulation)

The various errors and measured values have the following meaning (FSK signals):

FSK deviation DEVIATION:
The FSK deviation is determined by the square difference between measurement and reference signal (formed on the basis of the known demodulated bits and modulation parameters) being minimized. The

frequency offset is determined separately and indicated under Freq Error. The frequency error is not considered in the indicated FSK deviation.

FSK deviation error:
The FSK deviation error is the deviation difference between the measured signal and the reference signal, measured as an rms and peak value over all symbols. Frequency errors (frequency offset) are part of the indicated FSK deviation error.

With Normalize On the entered FSK reference deviation is used for scaling of the reference signal.

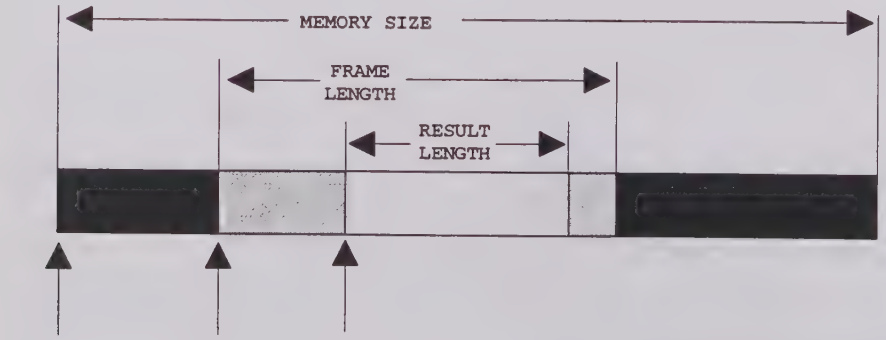
With Normalize OFF the reference signal is automatically derived from the measurement signal on the basis of the known demodulated symbols and modulation parameters so as to ensure maximum agreement between measurement and reference signal.

Magnitude error:
With FSK, the magnitude error is the deviation of the individual amplitudes of the AM envelope from the mean (rms) carrier amplitude, measured as an rms value over all symbols displayed and as a peak value normalized to the rms amplitude in %.

Frequency error:
The frequency error is the deviation of the FSE center frequency from the measured carrier frequency. It is derived from the frequency shift to be effected for synchronization to the carrier. The reference error of the FSE is also part of the frequency error.

2.4.3.5 Selecting Memory Size, Demodulation Length and Display Range

The size of the capture buffer containing the stored samples, the frame length to be demodulated and displayed and the number of points per symbol can be set to allow an adaptation to the measurement or to optimize the measurement speed.
At the beginning of a measurement, FSE stores the samples into the capture buffer which can be selected between 1 and 16-k symbols. It then tries to find the suitable FRAME LENGTH for further processing according to the trigger condition (*FIND BURST*). The FRAME LENGTH to be displayed or used for error calculation is defined with *RESULT LENGTH*. It can be positioned within the *FRAME LENGTH* by synchronization sequence triggering.



Finally, the number of points per symbol can be determined which allows the maximum number of symbols that can be processed in the *FRAME LENGTH* to be determined.

The settings are carried out in the *MEAS RESULT* submenu:

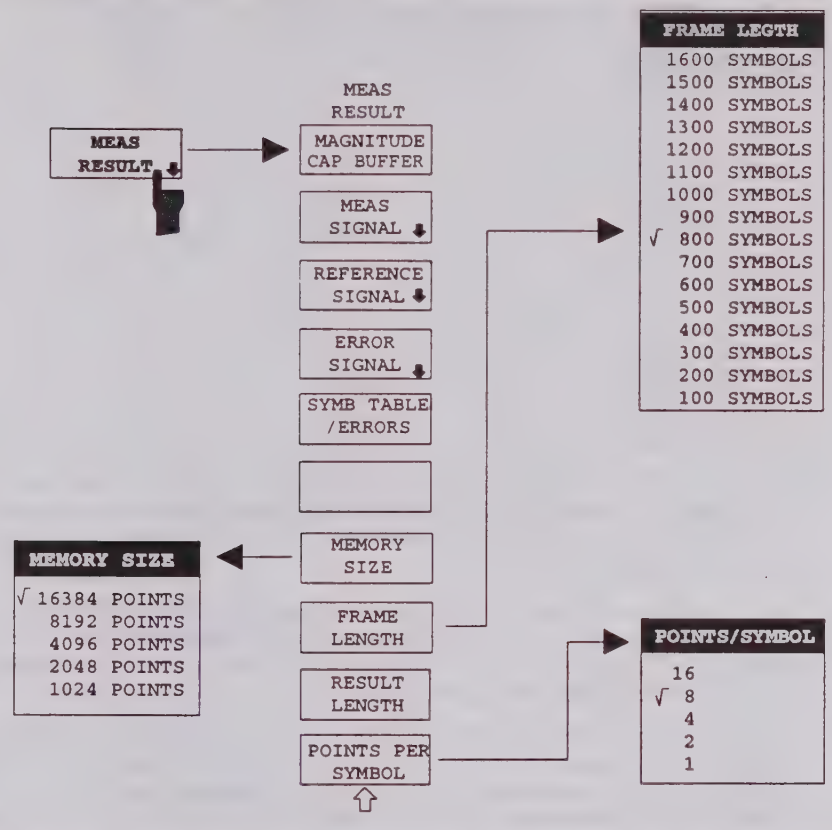
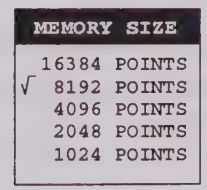


Fig. 2.4-12 Menus for selecting and displaying measurement results with digital demodulation

The *MEMORY SIZE* softkey calls up a table in which the number of samples saved in the capture buffer per measurement is determined. Within the *MEMORY SIZE* a burst, eg in the case of a TDMA signal, can be searched for (*FIND BURST* function).



Only the symbols entered under *FRAME LENGTH* are used for demodulation.

For symbol rates > 1 MHz the data are stored in the memory without prior filtering and reduction. The maximum memory size is therefore reduced to 4096 points.

The *FRAME LENGTH* softkey calls up a table in which the number of symbols to be demodulated or evaluated is defined.

FRAME LENGTH
1600 SYMBOLS
1500 SYMBOLS
1400 SYMBOLS
1300 SYMBOLS
1200 SYMBOLS
1100 SYMBOLS
1000 SYMBOLS
900 SYMBOLS
√ 800 SYMBOLS
700 SYMBOLS
600 SYMBOLS
500 SYMBOLS
400 SYMBOLS
300 SYMBOLS
200 SYMBOLS
100 SYMBOLS

With up to 4 *POINTS PER SYMBOL* a maximum of 1600 symbols can be demodulated per measurement and their modulation parameters measured. With 8 points per symbol up to 800 symbols, and with 16 points per symbol up to 400 symbols can be handled.

With symbol rates >1 MHz to ≤1.28 MHz a maximum of 600 symbols can be handled. This is due to the fact that the data are stored in the memory without prior reduction. The subsequent reduction limits the FRAME LENGTH in the specified frequency range.

The *FRAME LENGTH* markedly influences the time required for evaluating a measurement signal. It is therefore recommended to choose the *FRAME LENGTH* as short as possible. 400 symbols, for example, are sufficient for determining the phase error of a GSM burst as only 147 symbols are to be evaluated. FSE automatically searches for the correct time domain by trigger functions *FIND BURST* and *FIND SYNC* .

The choice of the *FRAME LENGTH* influences the maximum number of points per symbol. With up to 400 symbols a maximum of 16 points, with >400 up to 800 symbols a maximum of 8 points and with >800 symbols a maximum of 4 *POINTS PER SYMBOL* is possible.

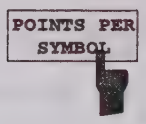
With symbol rates >1MHz to ≤1.28 MHz, the maximum number of symbols is 600!

The *RESULT LENGTH* softkey opens a window for defining the number of symbols for display on the screen.

RESULT LENGTH
80 Symbols

The maximum *RESULT LENGTH* is identical to the *FRAME LENGTH*.

With the *FIND SYNC* function activated (synchronization to bit sequences in the signal), the maximum *RESULT LENGTH* can be reduced (or the FRAME LENGTH increased).



With *POINTS PER SYMBOL* the number of points per symbol is determined. 1, 2, 4, 8 and 16 points per symbol can be selected. With one point per symbol, each point in the display corresponds to a symbol sampled at the time of decision. With n points per symbol, each n-th value is a point of decision. With 1 and 2 points per symbol, FSE demodulates with 4 points per symbol for reasons of accuracy. Only one or two samples are output, however.
For up to 4 points per symbol, a *FRAME LENGTH of max.* 1600 symbols is possible, with 8 points per symbol a *FRAME LENGTH of max.* 800 symbols and with 16 points per symbol of max. 400 symbols.

In the case of MSK demodulation, the number of points per symbol influences the result of the error measurement as all the points are considered in the calculation. With all other demodulators, only the values measured at the points of decision are taken into account. For GSM, DCS1800 and PCS1900, less than 4 points per symbol should not be used.

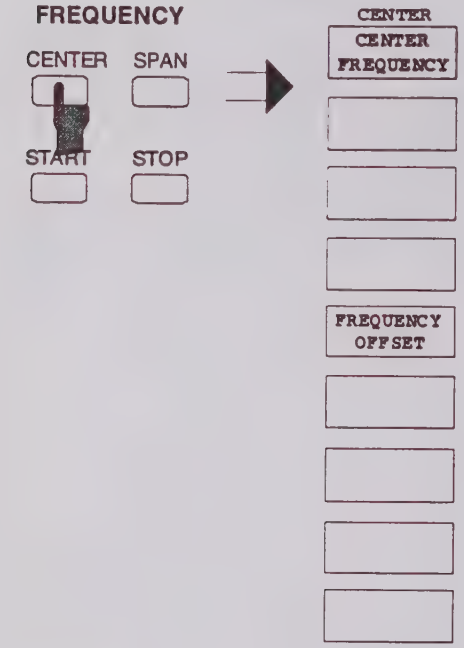
The number of points per symbol largely influences the measurement speed attained during the evaluation of the signal. If high measurement rates are to be attained for automatic tests, for example, a low number of points per symbol is recommended.

2.4.4 Setting the Frequency - FREQUENCY Key Block

In vector signal analysis, FSE is always set to a fixed frequency. The RF signal is analyzed by converting the signal into the complex baseband.

The frequency of FSE is set in the same way as in the spectrum analysis mode, ie with the *CENTER* key in the *FREQUENCY* key block.

FREQUENCY CENTER menu



The *ENTER* key calls up the field for the numeric entry which is next to the menu for the center frequency. The frequency can be numerically entered or modified with the rollkey or the keys ⌓ and ⌔.

For the demodulation of digitally modulated signals, the FSE frequency has to be accurately set to the frequency (carrier) of the signal to be mesured so that synchronization to the carrier is possible. The required setting accuracy depends on the symbol rate and must not exceed 2% of the symbol rate.

With the *FREQUENCY OFFSET* softkey, a frequency offset can be added to the frequency-axis labelling. The displayed frequency is shifted by the frequency offset. The range of values for the offset is 0 Hz to 100 GHz.

2.4.5 Setting the Frequency Span

The *SPAN*, *START* and *STOP* keys are not assigned in vector signal analysis for the demodulation of **digitally modulated** signals since FSE is always set to a fixed frequency and the measurement results are displayed in the time domain. The analysis bandwidth by which the demodulation is performed is predefined by the symbol rate and the number of sampling points.

2.4.6 Setting the Level Display and Configuring the RF Input

2.4.6.1 Setting the Reference Level

With spectrum analysis (ANALYZER mode) of the FSE, the level applied to the RF input is always indicated on the display so that one can see the relationship between the setting of the reference level and the measurement results on the display.

With vector signal analysis (VECTOR ANALYZER mode), this only applies to operating mode *DIGITAL DEMODULATION, DEMODULATION NONE.* In operating mode *DIGITAL DEMODULATION* with activated demodulation or *ANALOG DEMODULATION*, eg when the demodulated signal is displayed this relationship is not obvious. That is why a strict distinction has to be made between setting the **reference value** which is an important reference point for the measured-value display and the **reference level** relating to the RF input.

To obtain a maximum dynamic range it is important for the signal level at the A/D converter to be close to the maximum level of the converter. The maximum level of the converter corresponds to the reference level (*REF LEVEL*) in the spectrum analysis mode. This means that a signal whose amplitude attains the reference level in the spectrum analysis mode is ideal for the vector analyzer mode. An important factor is the **sum level** within the IF bandwidth (=*ANALOG BANDWIDTH* in vector signal analysis mode) of the analyzer.

The reference level can be manually set by checking the signal level in the spectrum analysis mode against the set frequency (at the same IF bandwidth!) and by operating the vector analyzer with the same setting.
FSE can perform this in vector signal analysis but also by a single automatic setting of the reference level.

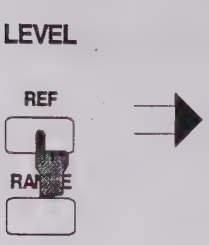
Certain settings of the spectrum analysis mode such as center frequency, reference level and attenuation are taken over by the vector signal analysis. Parameters that are not affected are span (in vector signal analysis, thefrequency span has a different meaning: it corresponds to the analysis bandwidth and is thus independent in the two operating modes), resolution bandwidth, ref. level offset as well as trace and trigger settings

The **reference value** (*REF VALUE*) of the vector signal analysis is the reference point for scaling the measured value. Apart from *DIGITAL DEMODULATION: RESULT DISPLAY: MAGNITUDE CAP BUFFER* it is decoupled from the setting of the reference level, ie a direct relationship cannot be determined.

With the***REF*** key, the **reference level** can be set like in the spectrum analysis mode.

The ***RANGE*** key calls up a menu comprising all the settings required for scaling the measured value such as AUTO scaling (*AUTO SCALE*), scaling (Y per Div), reference values in the X and Y direction (X/Y_REF VALUE) and the relative position of the reference value on the diagram (*REF VALUE POSITION*).

LEVEL REF Menu



The REF key calls up the menu for setting the reference level and at the same time activates the level entry field.

Operation and softkey functions:

RF ATTEN MANUAL
ATTEN AUTO NORMAL
ATTEN AUTO LOW NOISE
ATTEN AUTO LOW DIST
MIXER LEVEL
(identical to analyzer mode)

The *REF LEVEL* softkey activates entry of the manual gain of FSE. For a maximum dynamic range, it has to be ensured that the A/D converter is driven to its full range but not overdriven.

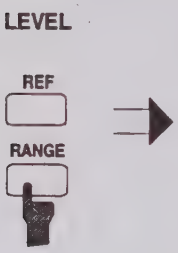
In the vector analyzer mode, this is indicated by the messages *IF OVLD* (overload) and *UNLD* (underrange) which inform on the dynamic range when measured data are read in.
When *IF OVLD* is displayed, the instrument or the A/D converter is overdriven during data read-in and entered data are invalid.
With *UNLD* displayed, the A/D converter is not sufficiently driven during data read-in (level <-6 dB of full range). Indicated values may have a reduced dynamic range, ie have a greater error.
For a correct level setting in the case of *IF OVLD*, reduce the REF LEVEL (continuous sweep mode) in sufficiently small steps (eg 2 dB) until the message disappears.
Proceed analogously for increasing the REF LEVEL when *UNLD* is displayed until the message disappears.
The maximum dynamic range is attained approx. 1 dB below the *OVLD* level.

The reference level can also be set to the test signal in the spectrum analysis mode at the same IF bandwidth as in the vector signal analysis mode (with *COUPLED: ANALOG BW AUTO* also 10 kHz) and vector signal analysis can then be selected again.

2.4.6.2 Setting the Display Range and Scaling - RANGE Key

The menu for setting the display range is different from that of the spectrum analysis mode.

LEVEL RANGE menu



With *RANGE* key, a menu is called up comprising all the important display parameters such as reference value, scaling etc.

The Y PER DIV softkey allows the entry of the vertical scaling in the current unit.

For vector or constellation diagrams, the corresponding X scaling is linked with Y scaling:

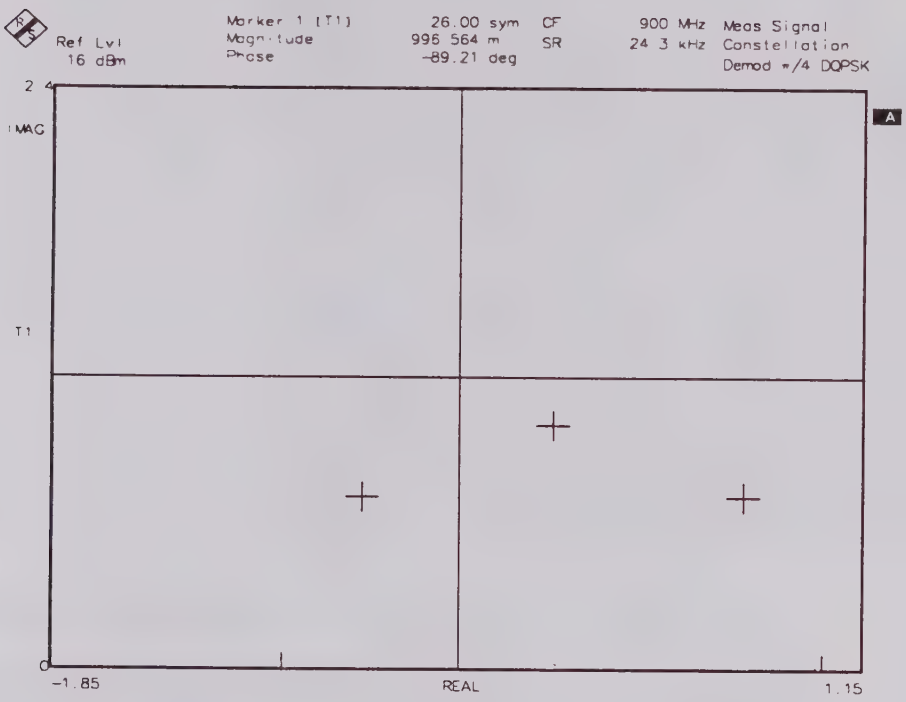
X PER DIV =5/4 *(Y PER DIV)

Reason: The diagram has 400 x 500 points. In case of a free X scaling circles would be reproduced as ellipses.

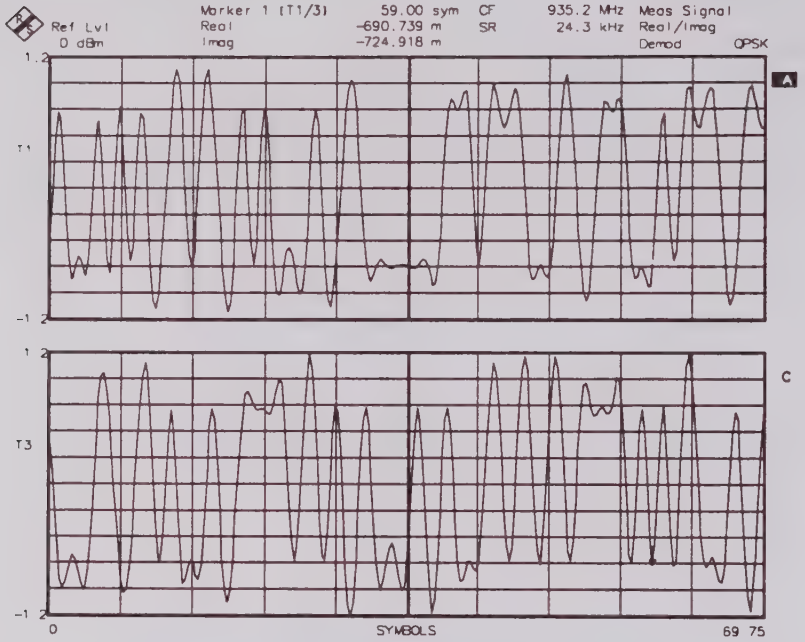
Softkeys *REF VALUE Y AXIS* and *REF VALUE X AXIS* call for the entry of the reference value for the Y or X axis of the measurement diagram. The *REF VALUE X AXIS* softkey is only displayed if a polar diagram has been selected for the trace.

The reference value is entered in the corresponding unit of the diagram (See *UNIT*).

Example 1: Vector diagram
y reference value: +1.20
x reference value: - 0,35
(reference position: 50%)



Example 1: Display of I and Q signals
Y reference value: -0.2
REF position: 50%

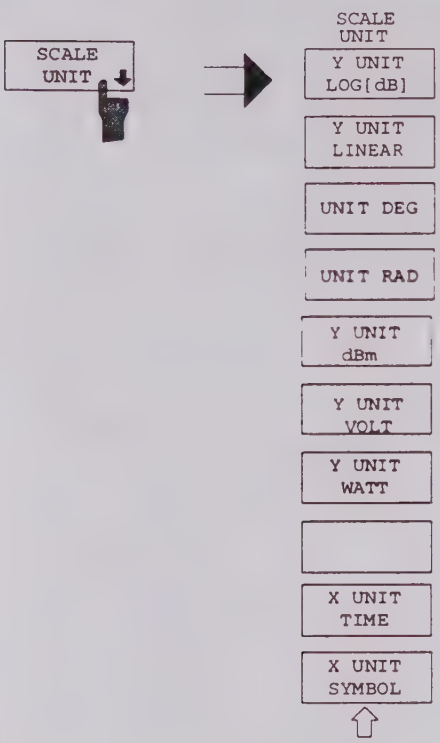


The *REF VALUE POSITION* softkey opens a window for setting the reference positions diverging from the basic setting.

REF VALUE POSITION defines the position of the reference value. It normally lies at 100%, ie the maximum displayable Y value is also the reference value. It is best to use this setting for displaying the magnitude which is then th basic setting.

When, for example, the timing of I/Q signals or the phase spectrum is displayed it might be desirable to set the reference value to the center. The basic setting is thus 50% (also for polar diagrams).

Submenu: *LEVEL RANGE - SCALE* UNIT



The *SCALE UNIT* softkey calls up a submenu in which the unit of the Y axis and the X axis are set.

The units offered depend on the setting of *RESULT DISPLAY* and *MEAS RESULT*.

For *DIGITAL DEMODULATION*, the logarithmic unit dB (*Y UNIT [dB]*) or dimensionless linear units (*Y UNIT LINEAR*) are permissible for the Y axis.

For error display and for RESULT DISPLAY: MAG, the unit for
Y UNIT[dB] is dB and for *Y UNIT LINEAR:* % .
or
errors of REAL/IMAG PART are always displayed in %.

Phase errors are displayed in DEG or RAD, frequency errors in Hz.

Only for RESULT DISPLAY: MAGNITUDE CAP BUFFER:

Possible display units: YUNIT LOG [dB], YUNIT LINEAR, **dBm , Volt and Watt**.

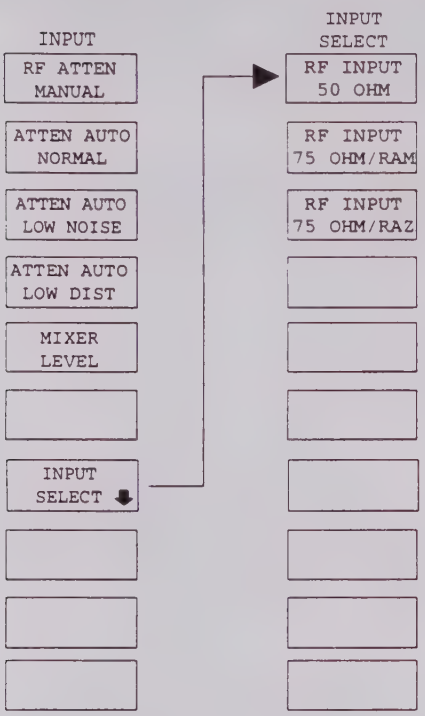
Units that are not permitted in the current operating mode cannot be used.

Table 2.4-3 Allocation table of selectable units or, in case of error display, of the displayed units in operating mode *DIGITAL DEMODULATION* depending on *RESULT DISPLAY* and *MEAS RESULT*

RESULT DISPLAY / MEAS RESULT	MAGNITUDE CAP BUFFER	MAGNI-TUDE	PHASE	FREQU ENCY [with FSK and MSK only]	REAL/IMAG PART	EYE DIAG	POLAR [IQ] VECTOR	POLAR [IQ] CONSTELL
MEAS SIGNAL	Y_UNIT LINEAR Y-UNIT LOG[dB] dBm VOLT WATT	Y_UNIT LINEAR Y-UNIT LOG[dB]	PHASE DEG/RAD	Hz	Y_UNIT LINEAR	Y_UNIT LINEAR	Y_UNIT LINEAR	Y_UNIT LINEAR
REFERENCE SIGNAL	--	like MEAS SIGNAL	like MEAS SIGNAL	like MEAS SIGNAL	like MEAS SIGNAL	like MEAS SIGNAL	like MEAS SIGNAL	like MEAS SIGNAL
ERROR SIGNAL	--	[%] or [dB]	PHASE DEG/RAD	Hz	--	-	-	-
VECTOR ERROR	--	[%] or [dB]	DEG/ RAD	--	[%]	-	[%]	[%]

2.4.6.3 Configuration of RF Input in Vector Signal Analysis

This section is identical to that of the spectrum analysis mode (see FSE manual).

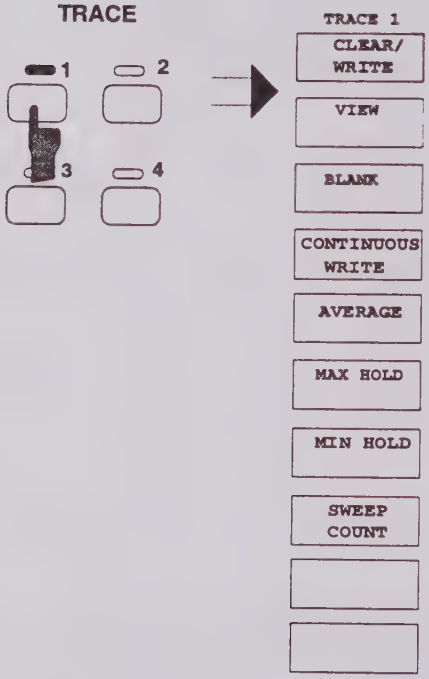


Note:
The operating mode recommended for the vector analyzer input is *ATTEN AUTO NORMAL:*
With *ATTEN AUTO LOW NOISE* (or at a *MIXER LEVEL* ≥-30 dBm) the higher signal level within the IF bandwidth causes higher intermodulation products and higher measurement errors depending on the type of signal.

2.4.7 Selection and Setting of Traces - TRACE Key Block

The function of keys TRACE 1 to 4 in vector signal analysis is largely identical with the function in *ANALYZER* mode as long as traces are displayed. If numeric values or tables (eg *SYMBOL TABLE*) are displayed, they are also linked with a trace (some of the trace functions are not available then).

Example: In diagram *SYMB TABLE / ERRORS* the symbol table refers to trace 1 and the error table to trace 2. (Not for *SPLIT SCREEN*!)



When TRACE keys 1 to 4 are pressed, a menu is opened in which the selected trace can be set.

The *CLEAR/WRITE* softkey displays a new trace for each measurement or outputs a measured value. Values from previous measurements are deleted.

The *VIEW* softkey freezes the current contents of the trace memory and displays them. If the device setting is changed, the displayed trace does not change. The measurement data are then invalid with reference to the current setting. This is shown by the enhancement label "*" at the right grid end.

The *BLANK* softkey blanks the trace or the measured values on the display. They are internally stored so that they can be displayed again with the aid of *VIEW*. The markers linked to a trace are also deleted with *BLANK*, but restored after reactivation of the trace with *VIEW* or *CLEAR/WRITE*.

The *CONTINUOUS WRITE* softkey outputs measured values for each sweep or displays a trace without clearing the previous measurements.

This function can be useful for the display of the constellation or eye diagram, where test runs are required for in-depth information.

The *AVERAGE* softkey switches the trace averaging on. The average value is derived from several sweeps.

After switch-on of averaging, the first trace is written in the *Clear/write mode*. Successive averaging is performed from the second sweep.
Averaging is restarted if the *AVERAGE* softkey is pressed. The trace memory is then deleted. This is also the case if the trace memory is set to *VIEW* or *BLANK* in the *AVERAGE* position.

If the *AVERAGE* function is active, the highest values are indicated for peak values (incl. AMPLITUDE DROOP)) for the display of the error table. A square averaging is performed for RMS values. For all other displays a linear averaging is performed.

Switch-on of function *AVERAGE* on a trace where the summary markers are active results in a switch-off of summary markers (see also section 2.3.11.3). On the other hand, summary markers cannot be activated on a trace if one of the *AVERAGE (or MAX HOLD or MIN HOLD)* functions is switched to this trace.

Description of average procedure:

Two calculation procedures are available for averaging. If the sweep number is 0, a continuous average value is formed according to the following equation:

$$\text{TRACE} = \frac{9 * \text{averaged measured value} + \text{measured value}}{10}$$

Because of the weighting carried out between the new measured value and the trace average value, no further points are added to the displayed trace after ten sweeps. In this setting, the signal noise is already effectively reduced without having to restart averaging at a signal change.

If the sweep number is >1, an averaging is carried out via the fixed number of sweeps. In this case, the displayed trace is evaluated according to the following equation:

$$\text{TRACE} = \frac{(n-1) * \text{averaged measured value} + \text{measured value}}{n},$$

where n indicates the number of the current sweep (n = 2 ... Average Sweeps). No averaging is carried out for the first sweep but the measured value is directly taken over into the trace memory. With increasing n, the displayed trace becomes more and more smooth as more sweeps are available for averaging.

The measured value is stored in the trace memory after the completion of the entered number of sweeps. A partial average value is indicated until this number of sweeps is attained.

In case of SINGLE SWEEP n single sweeps are triggered with *SWEEP START*. The sweeps are stopped as soon as the selected number of sweeps is attained. The number of the current sweep and the total number of sweeps are displayed: "SWP 3 OF 200".

In case of *CONTINUOUS SWEEP*, evaluation is also continued after having attained the maximum number of sweeps so that previous values become less and less important.The display: "SWP OF 200" does not change unless a new start is initiated.

The SWEEP COUNT softkey activates the entry of the number of sweeps required to perform the averaging.
The permissible range of values for the Sweep Count is 0 to 32767. In case of 0, FSE carries out a running averaging over 10 sweeps in the Average mode. No averaging is performed in case of 1.

The default setting is 10 sweeps (Sweep Count = 0). Programming of course influences the sweep duration. The number of sweeps required for averaging or the average time are identical **for all 4 traces.**

Note: *This sweep number setting in the trace menu is equivalent to that of the sweep menu. If both averaging and hold functions of the summary markers or trace averaging (or MAX HOLD or MIN HOLD) are active on different traces, the SWEEP COUNT counter simultaneously refers to summary markers and trace averaging.*

The *MAX HOLD* softkey activates peak-value averaging.
For every sweep run, FSE identifies the highest value and compares it with the current value. The highest of the two values is then stored in the updated trace memory. Thus, the maximum value of a signal can be evaluated over several test runs.

The trace memory is deleted by pressing the *MAX HOLD* softkey again. Peak-value averaging is started again.

.

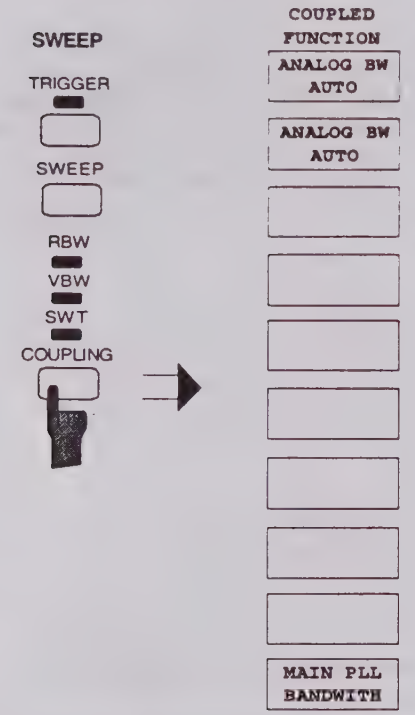
The *MIN HOLD* softkey activates minimum-value averaging. For every sweep run, FSE identifies the smallest of the two values and compares it with the current value. The smallest of the two values is then stored in the updated trace memroy FSE. Thus, the minimum value of a signal can be evaluated over several test runs.

The trace memory is deleted by pressing the *MIN HOLD* softkey again. Minimum averaging is stared again.

2.4.8 Setting the Analog Bandwidth - SWEEP Key Block

In the vector analysis mode, bandwidth limiting is not at the IF but in the baseband by means of digital filtering. The analog IF filters only serve for attenuating far off signals. The IF filters are set more broadly as required by the signal to be measured in order to increase the measurement accuracy. Thus, the measurement signal is less distorted by the amplitude and phase response of the IF filtering.

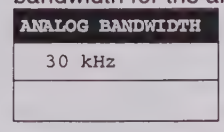
SWEEP COUPLING menu



The COUPLING key calls up the menu for setting the analog bandwidth.

With *ANALOG BW AUTO,* FSE automatically sets the resolution bandwidth to the maximum 10-MHz bandwidth for digitally modulated signals.

The *ANALOG BW MANUAL* softkey opens a window for entering the bandwidth for the analog prefilering.



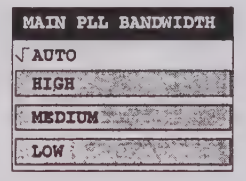
With *ANALOG BW MANUAL,* FSE can be manually set. When the demodulators are used for digitally modulated signals, the minimum analog bandwidth corresponds to the set symbol rate. Since modulation errors increase when narrow analog bandwidths are selected because of the amplitude and phase distortions, UNCAL is displayed for analog bandwidths below 10 times the symbol rate.

Bandwidths below 1 kHz cannot be set as the smallest bandwidth implemented by analog filtering is 1 kHz. When a smaller bandwidth than permitted is set, FSE signals:

RBW out of range

MAIN PLL BANDWIDTH

The *MAIN PLL BANDWIDTH* softkey opens a selection window for setting the PLL control bandwidth.



The first local oscillator is synchronized with the PLL control bandwidth. The control bandwidth determines the characteristic of the phase noise. A medium or high control bandwidth improves the phase noise for frequency differences smaller than 10 kHz to the carrier, wheras a low control bandwith improves the phase noise for frequency differences larger than 100 kHz to the carrier. If the control bandwidth is set unfavourably, the phase noise is deteriorated.

The PLL bandwidth is set in the AUTO mode depending on the RBW and SPAN according to the following tables:

Models 20 without option B4:

MAIN PLL BANDWIDTH	SPAN ≤ 50 kHz and RBW < 1kHz	SPAN > 50 kHz or RBW ≥ 1kHz
HIGH		
MEDIUM	X	
LOW		X

Models 30 or models 20 with Option B4:

MAIN PLL BANDWIDTH	SPAN ≤ 100 kHz and RBW < 3kHz	SPAN > 100 kHz or RBW ≥ 3kHz
HIGH	X	
MEDIUM		X
LOW	*	

The setting is chosen such that the phase noise for small spans with small resolution bandwidth near the carrier is optimized.

For measurements with small span but with a relatively large frequency difference to the carrier (>100kHz), the automatic bandwith setting deteriorates the phase noise relative to the optimal setting. The *MAIN PLL BANDWIDTH* softkey allows to by-pass this automatic setting. Optimal settings are, as a function of the carrier difference @:

Models 20 without option B4:

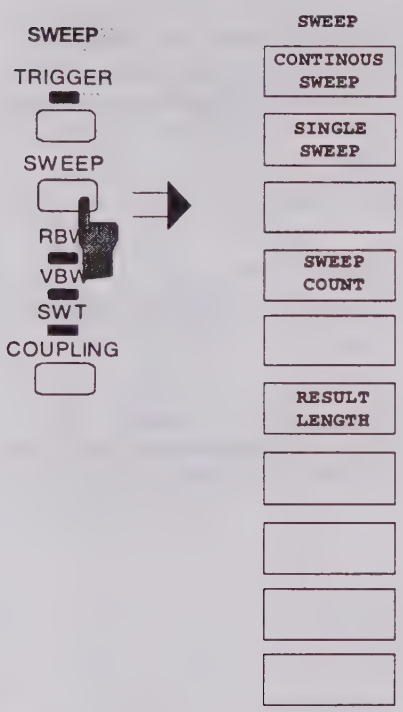
MAIN PLL BANDWIDTH	@ ≤ 10 kHz	@ > 10 kHz
HIGH		
MEDIUM	X	
LOW		X

Models 30 or Models 20 with Option B4:

MAIN PLL BANDWIDTH	@ ≤ 10 kHz	10 kHz < @ < 100 kHz	@ ≥ 100 kHz
HIGH	X		
MEDIUM		X	
LOW			X

If a larger control bandwith is needed due to the sweep velocity, the processor automatically increases the control bandwith as far as necessary.

2.4.9 Sweep Menu



The SWEEP key calls up a menu in which the type of measurement - single measurement or continuous measurement - and the measurement result length to be displayed in time or symbols are defined.

The *CONTINUOUS SWEEP* softkey starts a continuous measurement after defining the trigger condition and selected measurement settings. Following triggering, the measured values will be collected and then evaluated and displayed.

If, for split screen display, measurements in both windows are in the vector analysis mode, data in the measurement RAM are used for the two evaluations.

The *SINGLE SWEEP* softkey starts n measurements with the given trigger settings. The number of sweeps n is determined with *SWEEP COUNT*. The measurement is stopped after n measurements. It can be restarted by pressing *SINGLE SWEEP* again or by *CONTINUOUS SWEEP*.

Softkey SWEEP COUNT opens a window for entering the number of measurements for the SINGLE SWEEP.

The number of measurements can be selected between 0 and 32767.

With averaging of measured values set (AVG/HOLD ON, MODULATION MARKER: RMS can be found under MARKER SEARCH key), SWEEP COUNT also determines the number of measurements required for averaging.

For SWEEP COUNT = 0, 10 measured values are used for a running averaging.

For SWEEP COUNT = 1, no averaging is performed.

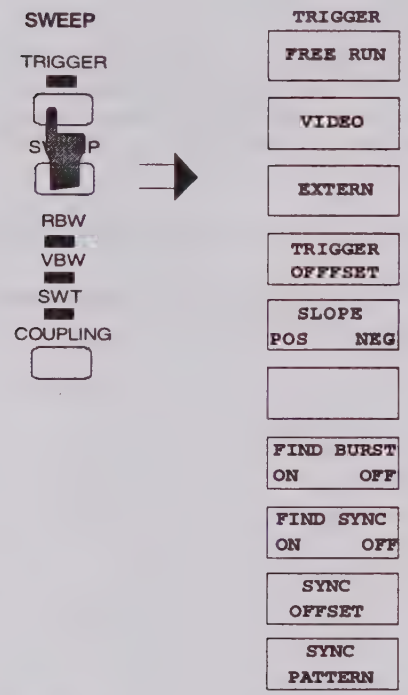
For SWEEP COUNT >1, averaging is performed for the set number of measured values.

The RESULT LENGTH softkey is only active in setting DIGITAL DEMODULATION. The number of symbols or the time slot to be displayed is defined with this key. The maximum number of symbols that can be displayed is with FRAME LENGTH.

2.4.10 Triggering Data Storage

The trigger in the vector analyzer mode determines the time from which data are stored in the result memory. For the demodulation of digitally modulated signals, the time reference can also be obtained by synchronization to a given bit sequence or, for TDMA signals, by searching for a burst in the result memory.

Menu: *SWEEP TRIGGER*



The TRIGGER key opens a menu in which the different trigger sources can be set and trigger slopes selected.

The *FREE RUN* softkey activates the measurement without trigger. After a measurement, the memory is prepared to store data for a new measurement.

The free-run mode is recommended if a continuously modulated signal is applied to the RF input or, for TDMA signals, the capture time is long enough to enter a full burst into the result memory.

The capture time is influenced by the MEMORY SIZE (max. 16384 points), the set symbol rate as well as the number of points per symbol.

The *VIDEO* softkey starts the measurement by the video voltage of the analog path of the spectrum analyzer. Parallel to the vector signal analyzer, the analog video voltage of the spectrum analyzer is evaluated.

Video triggering calls for the entry of the trigger threshold. It is identical to the trigger threshold of the spectrum analyzer. The entry of the trigger threshold into the data window is numeric in % of the last grid which has been active in the analyzer mode.
To determine a suitable value for the trigger threshold it is possible to switch to the display MAGNITUDE CAP BUFFER or to measure the threshold in the analyzer mode.

Softkey *EXTERN* activates triggering by means of an external voltage between -5 V to +5 V at the rear BNC connector *EXT TRIGGER / GATE*. The desired value is to be entered into the window.

TRIGGER OFFSET opens a window for entering the desired offset.

With *TRIGGER OFFSET*, the start time for the data storage relative to the trigger event is determined. Both positive values (for a trigger delay) and negative values (for a pretrigger) are permitted.

Entry is in absolute time independent of the scaling of the X axis.

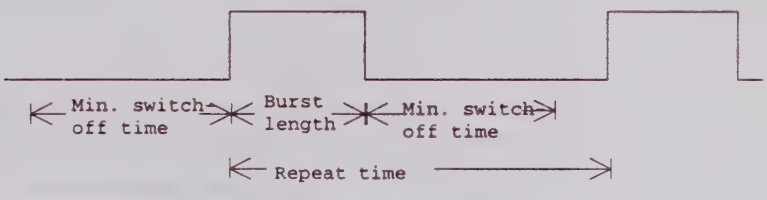
For positive values of the trigger offset (trigger delay), values from 1 µs to at least 10 ms are permitted, depending on the symbol rate and the number of points per symbol. The range of values for negative trigger offsets (pretrigger) depends on the selected memory size and is not more than half the memory size.

SLOPE POS/NEG determines the trigger slope in case of triggering by means of the video signal or external trigger.

The sweep starts after a positive or negative slope of the trigger signal. With a free-running trigger (*FREE RUN*) the setting is irrelevant.

With *FIND BURST ON*, FSE searches for a burst in the stored data (within the entered *MEMORY SIZE*), demodulates it within the entered *FRAME LENGTH* and displays it with the set *RESULT LENGTH*. The *FIND BURST* mode is particularly useful for TDMA signals if a burst is to be completely displayed (and would otherwise not be demodulated due to the mark-to-space ratio at the maximum settable *FRAME LENGTH* of 800 symbols). The time required for searching for a burst is determined with *MEMORY SIZE*.
A burst must have a minimum length of 30 symbols to be identified.

Digital communication systems operating according to the TDMA access methods transmit or receive information in the form of bursts. The carrier power is only switched on for a certain time. The transmitter switches the carrier on if an information is to be transmitted and switches it off again.



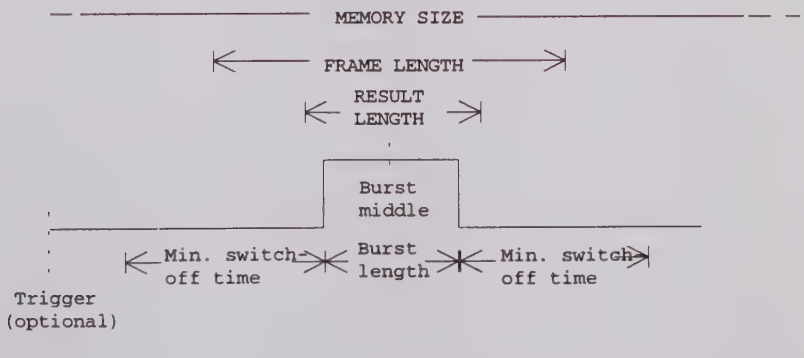
The carrier power is switched off between two bursts. With *FIND BURST*, FSE searches for a complete burst, ie for a carrier that can be switched on ***and*** off. If no complete burst is found within the search time, the message *BURST NOT FOUND* is displayed.

If a trigger (Video or Extern) is used for the storage of the measured values, a negative trigger offset (pretrigger) is recommended so that a sufficiently long switch-off time of the carrier is available at the beginning of the search time.

The search time has at least to be as long as the burst length plus twice the switch-off time to ensure that the burst is found.

For a free-running trigger, set the length of the captured data *(MEMORY SIZE)* to a minimum (repeat time + 2 x switch-off time + burst length) so that the burst can be found.

FSE centres the number of symbols (*FRAME LENGTH*) required for demodulation as well as the displayed symbols (*RESULT LENGTH*) to the center of the found burst (*FIND SYNC OFF*).

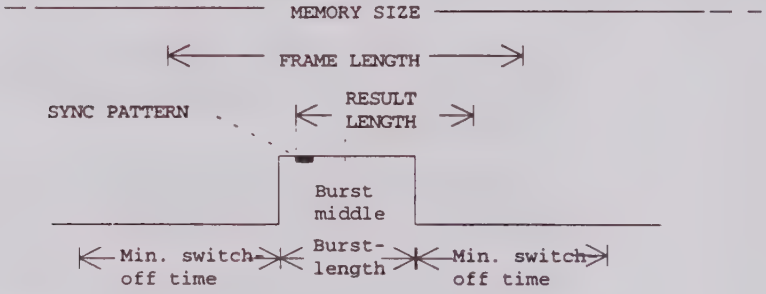


Centering the burst on the middle of the picture cannot be carried out if the burst is found at the very beginning of the data set (of the memory size) and a **Result Length >Burst Length + 2*20 symbols** is set. A precondition for burst recognition is that before the rising edge measrued values corresponding to at least 20 symbols are present in the current trace memory. In this case, the burst is represented from the first measured value in the trace memory.
If the consequent centering of the burst is indispensable for the user, the RESULT LENGTH has to be reduced according to the above precondition.

With *FIND SYNC ON*, FSE searches for a defined bit sequence (*SYNC PATTERN*) within the set *FRAME LENGTH*. The measurement result is displayed with the set *RESULT LENGTH* with reference to the first symbol of the synchronization sequence.

If the synchronization sequence is not found, a result is still output according to the set *RESULT LENGTH*.

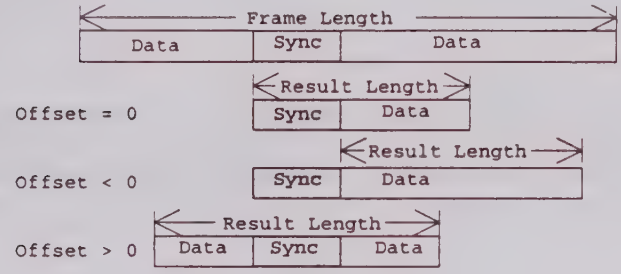
Message: *SYNC NOT FOUND* is then output.
In case of *FIND BURST ON* and *FIND SYNC ON*, FSE only centers the *FRAME LENGTH* to the center of the burst while the *RESULT LENGTH* is displayed from the beginning of the bit sequence (in case of *SYNC OFFSET* 0) or around the *SYNC OFFSET*.



SYNC OFFSET

SYNC OFFSET opens a window for entering the offset in symbols.

SYNC OFFSET defines the display time prior to the synchronization sequence in SYNC SEARCH. It thus determines the position of the displayed trace or symbols (*RESULT LENGTH*) within the demodulated signal (*FRAME LENGTH*). The modulated signal may have a preamble or a midamble. Depending on the configuration it is thus desirable to display the measurement signal from a synchronization sequence or prior to the synchronization sequence.



A positive or a negative offset can be set.

The minimum or maximum offset depends on the following parameters:

- frame length and
- result length

Any offset can basically be entered provided that the measurement result is within the frame length. If the frame length is extended, a higher offset can be entered. If the result length is extended, the maximum offset is reduced.
The FRAME BUFFER contains the data available for the evaluation (FRAME LENGTH).

The command „SYNC OFFSET INVALID“ indicates that there are not enough data available for displaying RESULT LENGTH.

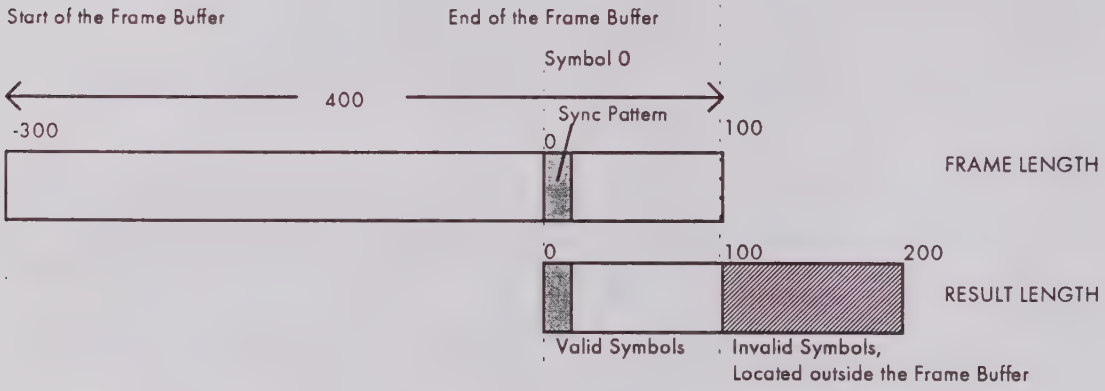
The following examples explain how FRAME LENGTH, SYNC OFFSET and RESULT LENGTH are related.

Example 1 (input signal without burst):

Device settings:

- Input signal (without burst)
- FIND BURST off
- FIND SYNC on
- FRAME LENGTH = 400
- RESULT LENGTH = 200
- SYNC OFFSET = 0

The start of the FRAME BUFFER is at SYMBOL -300 (with respect to the sync pattern), the FSE displays the results starting with symbol no. 0, but there are no more than 100 valid symbols in the file, 100 symbols of the RESULT LENGTH are invalid because they are located outside the frame buffer.



Solution:

- Diminish RESULT LENGTH to 100 symbols

or

- Extend FRAME LENGTH to 800 symbols.

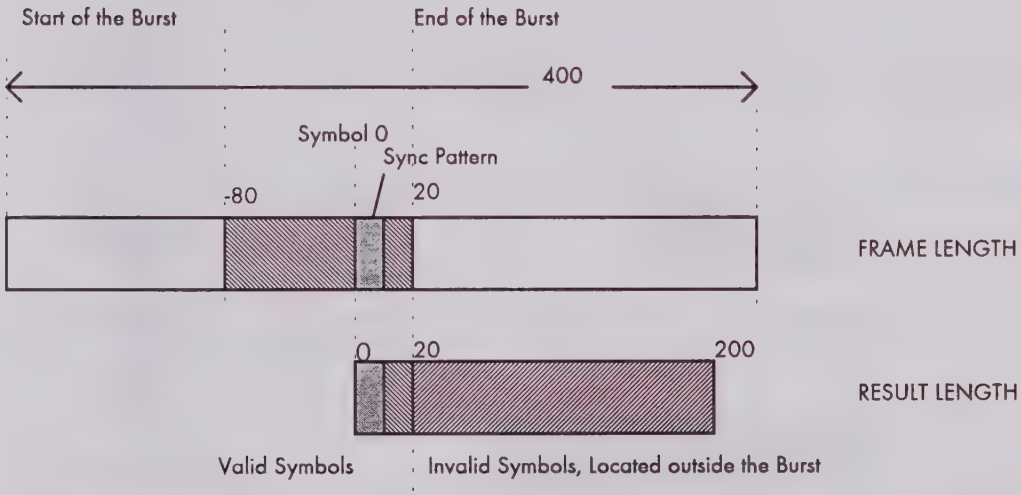
Example 2 (input singnal with burst):

Device settings:

- Input signal (burst length 100 symbols)
- FIND BURST on
- FIND SYNC on
- FRAME LENGTH = 400
- RESULT LENGTH = 200
- SYNC OFFSET = 0

After successful search of the burst, only the symbols inside the burst are marked as valid.

The synchronization pattern is found in the burst (Symbol 0), the FSE displays starting with symbol no.0, but there are only 20 valid symbols in the BURST, 180 symbols of the RESULT LENGTH are invalid because they are located outside the burst.



Solution:

- Diminish RESULT LENGTH to 20 symbols.

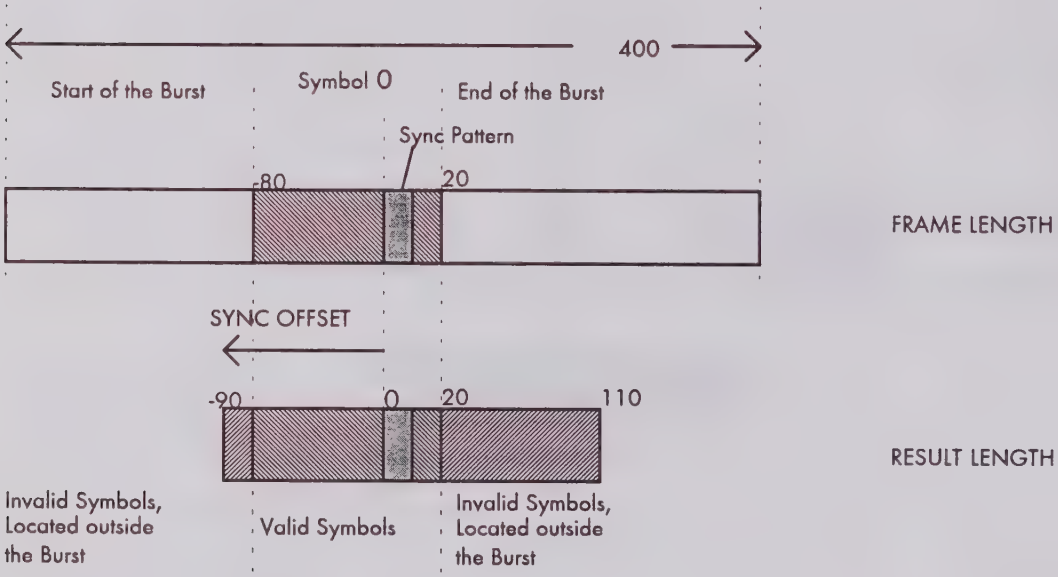
Example 3 (input signal with burst):

Device settings:

- Input signal (burst length 100 symbols)
- FIND BURST on
- FIND SYNC on
- FRAME LENGTH = 400
- RESULT LENGTH = 200
- SYNC OFFSET = 90

After successful search of the burst, only the symbols inside the burst are marked as valid.

The synchronization pattern is found in the burst (Symbol 0), the FSE displays starting with symbol no. -90 up to +19, the beginning of the display range is located before the start of the burst !



Solution:

- Diminish RESULT LENGTH to 100 symbols (= burst length)

and

- Set SYNC OFFSET to 80 (beginning of the burst lies 80 symbols before the sync-pattern).

SYNC PATTERN calls up a submenu, allowing to select available patterns. These patterns are displayed in a pattern-name table. If a pattern is activated, the bit sequence of the selected pattern is displayed in the pattern-value table. *SYNC PATTERN* defines a bit sequence which is searched for in the signal to be demodulated. When the *SYNC SEARCH* function is activated, this bit sequence is used for synchronizing measurement results. FSE demodulates the signal to be measured down to bit level and searches for this predefined sequence. The first symbol in the bit sequence is the reference time.
The bit sequence of digitally modulated signals often includes a preamble or midable which is used on the one hand for assessing the channel impulse response and setting the channel equalizer in the receiver and on the other hand to synchronize the receiver. This bit sequence may be used in the FSE to find and display particular signal sections.
The maximum pattern length of the FSE is 30 symbols. The number of bits depends on the significance of the modulation method. With QPSK, for instance, 30 symbols correspond to 60 bits, with 16QAM to 120 bits. FSE always uses an integral multiple of the bits per symbol. Bits which are not multiples or exceed the maximum length are omitted.

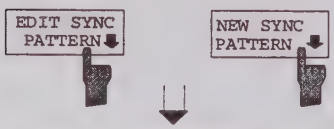
When the *SELECT PATTERN* softkey is pressed, the first field in the *PATTERN NAME* table is marked. The desired pattern is selected by means of the rollkey or the step keys and then activated with the enter key.
The bit sequence of the selected pattern is displayed simultaneously with the pattern value table.

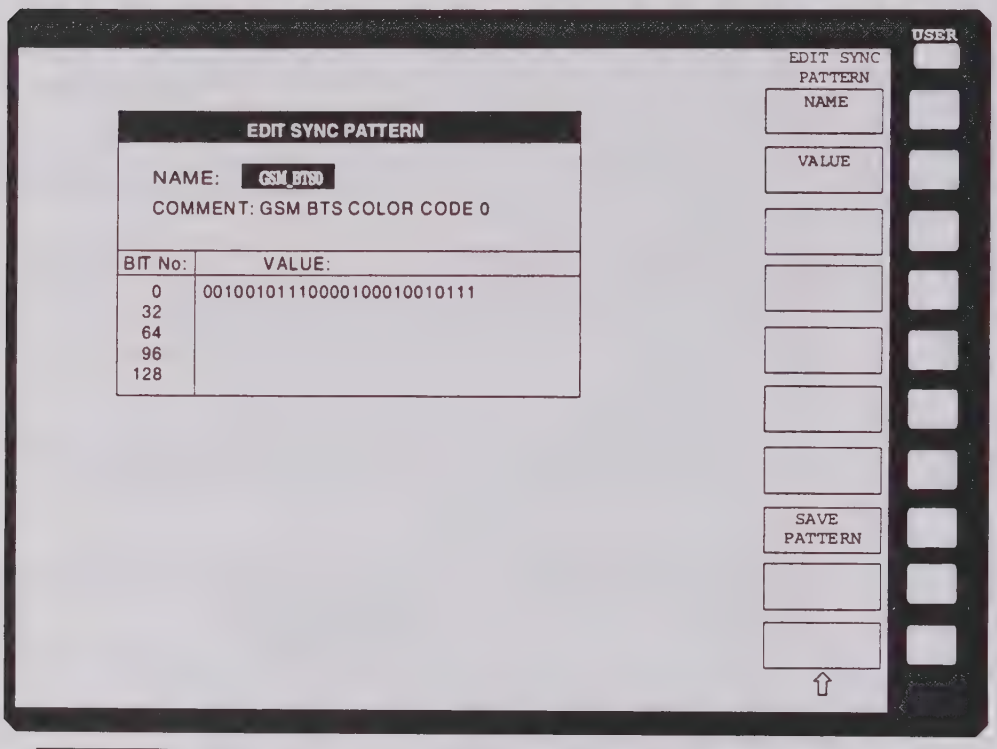
The *DELETE PATTERN* softkey clears the pattern marked by the cursor. To avoid the pattern being inadvertently deleted, a confirmation is required.

Pressing the *PAGE UP* softkey causes the next page of the sync pattern table to be displayed.

When the *PAGE DOWN* softkey is pressed, the last page of the sync pattern table is displayed.

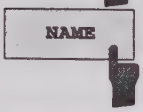
EDIT/NEW SYNC PATTERN submenu





Softkeys *NEW PATTERN* and *EDIT PATTERN* call up the *EDIT SYNC PATTERN* submenu for generating limit lines.
In the head line of the table the name and comment of the sync pattern to be edited or modified can be entered.

The sync pattern is entered or modified in the VALUES field.



With *NAME* the name and with *COMMENT* a comment for the sync pattern is entered or modified. A maximum of eight characters can be entered for the name. When the sync pattern is stored, the extension .PAT is automatically appended.

When the *VALUE* softkey is pressed the bit pattern of the sync pattern can be entered or modified.

SAVE PATTERN stores a newly edited pattern under the current name.

2.4.11 MARKER Key Block

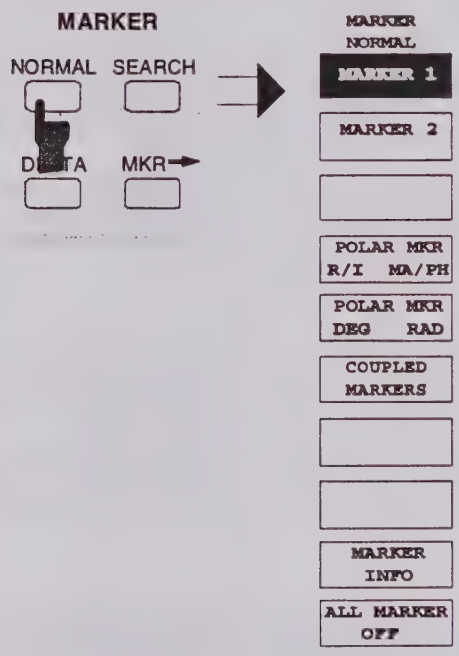
In the vector analyzer mode markers may be used for highlighting points in a trace and for reading out measured values.
For a detailed description of marker operation refer to section 2.9.3 in the FSE operating manual.

In the vector analyzer mode marker softkey functions depend on the selected operating mode.

2.4.11.1 Main Marker - NORMAL Key

The main markers and their functions are selected with the *NORMAL* key.

MARKER NORMAL menu



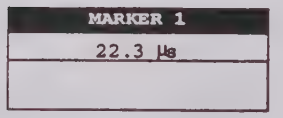
The *NORMAL* key calls up a menu comprising all standard marker functions. Activated marker functions are indicated by a dark background of the softkeys. If no marker is activated when the *NORMAL* key is pressed, MARKER 1 is activated as a reference and set to the maximum value in the curve. (automatic switch-on of peak search function provided at least one trace is active; not with polar diagram). In all other cases the reference marker is activated but no automatic peak search is performed.

In the marker field the marker position (time), the measured value or values (in the case of a complex display) and the trace relevant for the marker (here [T1]) are displayed.

Example:
Marker display in the digital demodulation and I/Q display mode:

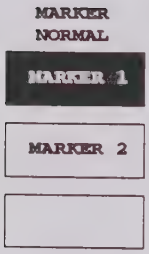
```
Marker 1 [T1/3] 22.3 µs
Real              0.998
Imag             -0.124
```

The window for modifying the marker position and the reference marker is opened. The marker can be moved by means of the rollkey, keys ⌓ ⌔ or by a numeric entry of the required marker position.



When the symbol table is displayed (softkey *SYMB TABLE/ERRORS* under *MEAS RESULT*) the marker moves from symbol to symbol in the table.

The position of the marker is indicated by a dark background and its numerical value in inverse video.
In the marker field, the marker position and the decimal value of the symbol are displayed.



Softkeys *MARKER 1* and *MARKER 2* switch the respective marker on or off or define it as an entry marker (reference marker). The softkeys of unused markers are not highlighted. The active marker and the reference marker are identified by a dark background colour of the associated softkey.
The number and position of the marker are indicated in the entry field. The position can be changed by means of the rollkey, the step keys or by a numeric entry. The step width can be set in the *STEP* menu (*DATA ENTRY* field).

In the polar diagram a selection can be made between magnitude and phase (*MA/PH*) and real and imaginary part (*R/I*) for the numeric result display. When measured values are indicated versus time this softkey is disabled.

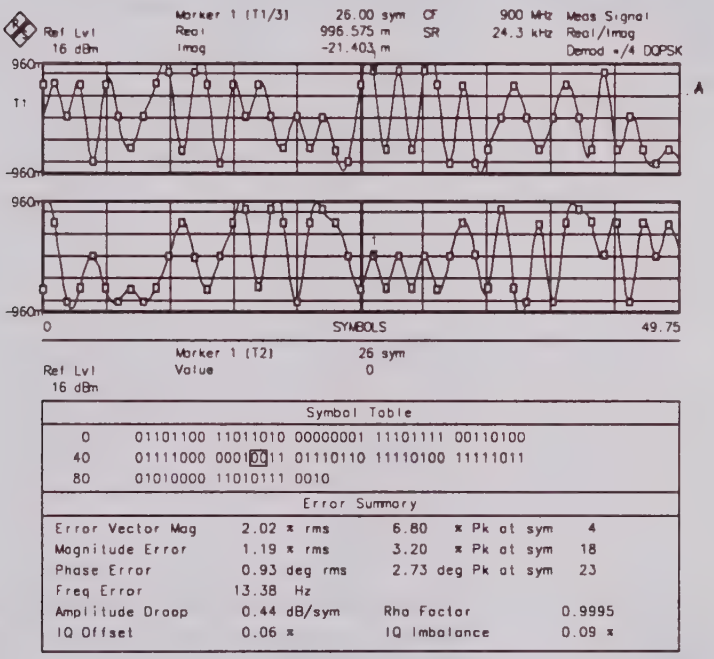
.

The phase of the marker can be indicated in the respective diagram in degree (*DEG*) or radiant (*RAD*). The softkey permits switchover between the two units.

COUPLED MARKERS

In the combined display mode *REAL/IMAG PART*, markers (and delta markers) of different traces are coupled when the *COUPLED MARKERS* function is active. In this case the X position of corresponding markers is identical.
This allows complex marker values to be displayed which correspond to the polar display.

Marker 1 6.75 SYM [T1/3]
RE 0.895
IM 1.002
If several windows are displayed, the markers of **all** windows are coupled when the *COUPLED MARKERS* function is active.



ALL MARKER OFF

With the *ALL MARKER OFF* softkey all markers including reference and delta markers are switched off and the marker entry window is closed.

When *ALL MARKER OFF* is pressed, also the *MARKER INFO* is automatically switched off.

MARKER INFO

In addition to the display of marker information in the marker field of the diagram headline, *MARKER INFO* allows several markers to be displayed in the grid. In the top right-hand corner of the grid the two markers or delta markers are displayed with symbols ∇/Δ, marker number (1, 2), position and measured value (may be complex). The number of symbols for specifying the marker position is limited in certain cases.

If there are not enough lines for displaying all active markers and delta markers, the markers are listed first and then the delta markers.

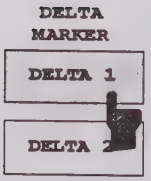
In the *SPLIT SCREEN* display this list is divided into two lists, one for *SCREEN A* and one for *SCREEN B*.

2.4.11.2 Delta Marker - DELTA Key

With the *DELTA* key in the MARKER block the delta markers are selected.

MARKER DELTA menu

Delta markers are always referenced to the active reference marker . When no marker is active, switching on a delta marker automatically activates marker 1. Delta markers are displayed as an unfilled symbol ▽. When the delta marker is active for entry, a filled symbol ▼ is displayed.



The *DELTA 1* and *DELTA 2* softkeys switch on delta markers 1 and 2. Operation of delta markers is identical to that of markers. When a delta marker is switched on, all entries apply to the delta marker. For changing the position of the main marker, the main marker has to be reactivated. Displayed differences normally apply to the active reference marker.

In the delta marker field, the number of the delta marker, the time difference to the reference marker and the difference of measured values between the active delta marker and reference marker are displayed.

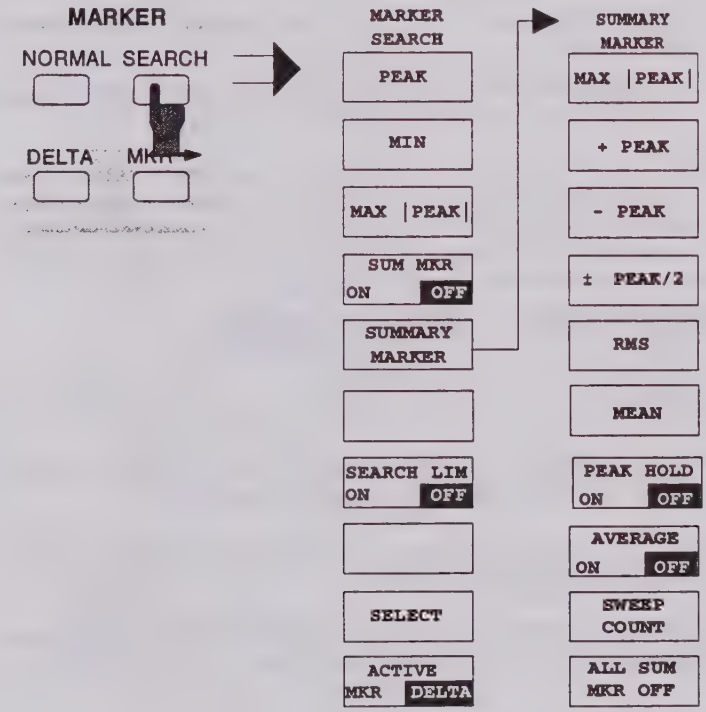
2.4.11.3 Search Functions (Marker Search menu) - SEARCH Key

The menus called up with *SEARCH* offer functions for a peak/min search and universal marker functions for overall evaluation of traces. The search functions can be used for markers and delta markers.

With polar diagrams, peak/min. peak values refer to the vector length (with origin as reference), in all other cases to the Y deflection. In this diagram, summary markers cannot be switched on or are not displayed.

When the *SEARCH* key is pressed while marker entry is active, all search functions are with reference to the current reference marker. When a delta marker is active, the functions apply to the corresponding delta marker. With no marker active, marker 1 is switched on automatically (by means of peak search) and used as reference marker. Search functions are then carried out with marker 1.

MARKER SEARCH menu



The search range can be limited by time lines (TIME LINE 1/2) switched on with *SEARCH LIM ON/OFF*. The limitation of the search range is valid for all the marker search functions including the SUMMARY MARKERS and for error calculation during *SYMB TABLE/ERRORS*.
The time lines are only visible for diagrams versus time, ie not for polar diagrams and for diagrams of *SYMB TABLE/ERRORS*. The limitation of the search range is valid for *SEARCH LIMITS ON* for all diagrams irrespective of whether the time lines are visible or not.

Functions in the *MARKER SEARCH* menu refer to the marker or delta marker active during entry. Switchover between the active marker and delta marker is possible with the *ACTIVE MKR DELTA* softkey.

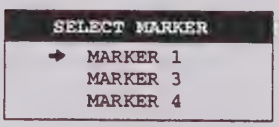
If no marker is switched on when the *SEARCH* key is pressed, marker 1 is activated as reference marker (by means of *PEAK SEARCH*).

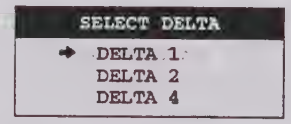
The *ACTIVE MKR / DELTA* softkey switches over between active marker and active delta marker.

With *DELTA* highlighted, subsequent search functions are carried out with the active delta marker.

Note: *Switchover between marker and delta marker entry is also possible with the NORMAL and DELTA keys.*

The *SELECT MARKER* softkey opens a window giving a list of the markers or delta markers currently switched on. A marker or delta marker can be selected by pressing *ENTER* or by entering the respective number. After the selection the window is closed and the corresponding marker/delta marker frequency entry is activated.





With *MAX IPEAKI* the active marker or delta marker is set to the highest magnitude displayed (*PEAK* or *MIN*) in the associated curve.

For instance, the function searches for the maximum phase error of a signal, which may be positive or negative.

The *PEAK* softkey sets the active marker or delta marker to the highest value displayed in the associated measured curve.

MIN sets the reference marker to the lowest value in the associated curve.

The SUM *MKR* softkey switches the display of the summary marker values in the marker info field on and off. The measured values are updated afer every sweep end (in case of AVG/*HOLD OFF).*

If one trace is in AVERAGE, MAX HOLD or MIN HOLD mode, the SUMMARY MARKERS for this trace cannot be switched on.

On the other hand, the summary markers are switched off if the TRACE functions: AVERAGE, MAX HOLD or MIN HOLD are activated (only valid for the same trace).

The maximum and average values can be maintained or displayed for all summary markers by means of function *HOLD ON/OFF* or *AVERAGE ON/OFF* if Sweep Count >0.

Example:
Marker info field for :
Summary Marker: + Peak and MEAN switched on, PEAK HOLD ON and AVERAGE ON:

```
▼1              63. sym
 MAGN CAP     2.40 Watt
+PEAK HOLD    2.55 Watt
+PEAK AV      2.39 Watt
 MEAN HOLD    2.33 Watt
 MEAN AV      2.29 Watt
```

The SUMMARY *MARKER* softkey calls up the submenu for selecting the *SUMMARY MARKER* values to be displayed in the marker info field.

The measured values are updated for every sweep.
(In case of setting *SYMB TABLE/ERRORS* the marker info field is not displayed).

The search range can be limited by time lines (***TIME LINE 1,2***) for peak- and Min-search functions as well as for the summary markers.

If *SEARCH LIMIT ON* is switched on, a search for the corresponding signals is only performed between the two lines (Default value: *SEARCH LIMIT OFF*).

If only one line is switched on, ***TIME LINE 1*** is valid as lower limit (the upper limit is the stop frequency), ***TIME LINE 2*** defines the upper limit value.

If no line is active, lines 1 and 2 are switched on automatically and positioned to 20 % and 80 % of the grid.

If the function is switched off, the lines continue to be switched on.

Time lines are not visible for polar diagrams and for Symb Table/Errors. The limitation of the search range, however, remains effective.

With this function switched on, the higher of the two peaks *+PEAK* and *-PEAK* is displayed per sweep in the marker info field.

The search range can be limited by means of function *SEARCH LIMITS ON*.

With the *PEAK HOLD* function activated, the highest peak value that has occurred since the activation of *PEAK HOLD* is displayed.

With the AVERAGE function activated, the highest peak values are averaged and displayed.

With this function switched on, the positive peak value is displayed per sweep in the marker info field.

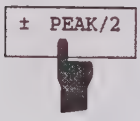
The search range can be limited with the function *SEARCH LIMITS ON*.

With the PK Hold function activated, the highest positive peak value that has occurred since the activation of *PEAK HOLD* is displayed.

With the AVERAGE function activated, the positive peak values are averaged and displayed.

With this function switched on, the negative peak is displayed per sweep in the marker info field.
The search range can be limited with the function *SEARCH LIMITS ON*.
With the PK Hold function switched on, the highest negative peak value that has occurred since the activation of *PEAK HOLD* is displayed.

With the AVERAGE function switched on, the highest negative peaks are averaged and displayed.



With this function switched on, the average value of the positive and negative peak is displayed per sweep in the marker info field.

The search range can be limited with the *SEARCH LIMITS ON* function.

With the PK Hold function switched on, the highest average value that has occurred since the activation of *PEAK HOLD* is displayed.

With the AVERAGE function switched on, the average values of the positve and negative peak value (versus time) are averaged and displayed.

With this function switched on, the rms value of the signal is displayed per sweep.

The search range can be limited with the *SEARCH LIMITS ON* function.

With the PK Hold function switched on, the highest rms value that has occurred since the activation of the *PEAK HOLD* function is displayed.

With the AVERAGE function switched on, the rms values are averaged versus time and displayed.

With this function switched on, the average value of the signal is displayed per sweep. Thus, the average carrier power can be measured during a GSM burst (during display of MAG CAP BUFFER).

The search range can be limited with the *SEARCH LIMITS ON* function.

With the PK Hold function switched on, the highest average value that has occurred since the activation of *PEAK HOLD* is displayed.

With the AVERAGE function switched on, the average values (of a trace) are averaged versus time and displayed.

The PEAK *HOLD ON / OFF* softkey switches the PK Hold function of the SUMMARY MARKERS on or off.

All active summary markers are only updated after every sweep end if higher values have occurred.

The measured values can be reset by switching the *PEAK HOLD ON / OFF* softkey off and on again.

The *AVERAGE ON / OFF* softkey switches the averaging of the summary markers on or off.

The measured values can be reset by switching the *AVERAGE HOLD ON / OFF* softkey off and on again.

With *SWEEP COUNT* the number of measurements (sweeps) is set in the ***SINGLE SWEEP*** mode. The number of measuements is defined in the data entry field.

The number of measurements can be selected between 0 and 32767.

If an averaging of measured values or the PEAK HOLD mode is set, *SWEEP COUNT* also determines the number of measurements required for averaging or maximum averaging.

If *SWEEP COUNT* = 0, 10 measured values are always required for a ***running*** averaging.

If *SWEEP COUNT* = 1, no averaging is performed.

If *SWEEP COUNT* >1, averaging is performed over the set number of measured values.

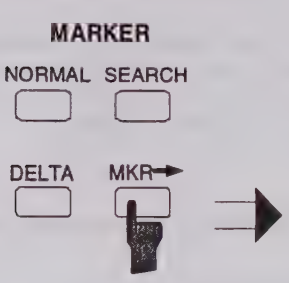
In case of ***CONTINOUS SWEEP*** FSE (*AVERAGE ON*) performs an averaging until the number of sweeps set under *SWEEP COUNT* is attained and then performs a running averaging.

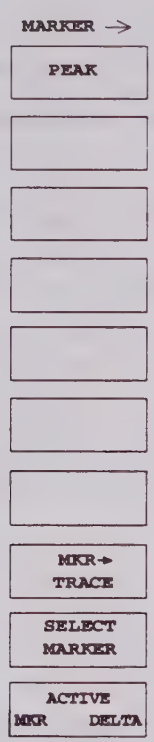
Maximum averaging is infinite irrespective of *SWEEP COUNT*.

The summary markers are switched off by means of the *ALL SUM MKR OFF* softkey.

2.4.11.4 Varying Instrument Settings by means of Markers - MKR→ Key

MARKER MKR→ menu





The *MKR* -> menu offers functions for varying instrument parameters by means of the currently active marker. Same as in the *SEARCH* menu, the functions are also valid for the delta markers.

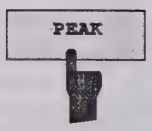
The selection of marker or delta marker depends on the currently active frequency entry for marker or delta marker. If no entry is active, the marker with the lowest number is activated as reference marker.

The *ACTIVE MKR / DELTA* softkey is used for switchover between active marker and delta marker.

With *DELTA* activated (highlighted), the following marker functions are carried out with the active delta marker.

Note: *Switchover between marker and delta marker entry is also possible by means of the* NORMAL *and* DELTA *keys.*

If no delta marker is active when *DELTA* is selected, delta marker 1 is activated (with peak search).



To simplify operation, the *PEAK* search function is also available in the *Marker→* menu.

The *MKR → TRACE* softkey opens a window in which the marker can be positioned on a new trace. Only selectable traces are displayed in the window.

2.4.12 Setup of Display and Limit Lines – *LINES* Key Field

2.4.12.1 Display Lines – *D LINES Key*

Display lines are aids which, similar to markers, make the evaluation of measurement curve data more convenient. The function of display lines is similar to that of a movable scale which can be used to measure absolute and differential values on measurement curves.
In addition, the display lines can also be used to limit the range of search for marker functions.

The FSE provides four different types of display lines:

- two horizontal threshold lines for marking measurement values or for defining measurement value search ranges – Display Line 1/2,
- two vertical time lines for marking times or for defining time search ranges – Time Line 1/2,
- a threshold line which, for example, sets the search threshold for maximum values (Peak Search) – Threshold Line
- a reference line – Reference Line

For purposes of clarity, each line is annotated on the right side of the display diagram by the following abbreviations:

D1 Display Line 1
D2 Display Line 2
T1 Time Line 1
T2 Time Line 2
TH Threshold Line
REF Reference Line

The lines for level, threshold and reference are displayed as continuous, horizontal lines over the full width of the diagram. They are movable in the y-direction.
The lines for time are displayed as vertical, continuous lines over the total height of the diagram. They are movable in the x-direction.

For measurement operations in two separate windows, (Split Screen-Modus), the display lines are available independently in both windows. In the currently active window, the display lines can be activated and/or shifted. Lines previously defined in the currently inactive window remain unchanged.

Note: *The softkeys for setting and switching the display lines on and off operate similar to a three-position switch:*
Initial condition: The line is switched off (softkey has grey background)

1st press: The line is switched on (softkey has red background) and data entry is activated. The position of the display line can be adjusted by using the roll-key, the step keys or through direct numerical inputs via the data-entry keypad. If some other arbitrary function is requested, the data-entry keypad is disabled. In this case, the display line remains switched on (softkey has green background).

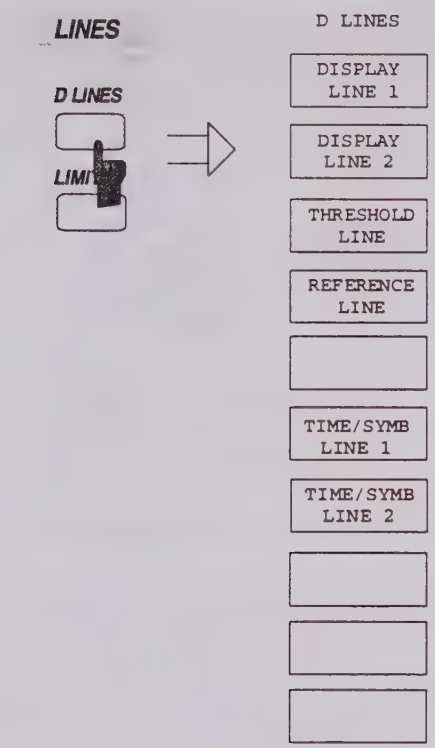
2nd press: The display line is switched off (softkey has grey background).

Initial condition: The line is switched on (softkey has green background)

1st press: The line is switched on (softkey has red background) and data entry is activated. The position of the display line can be adjusted by using the roll-key, the step keys or through direct numerical inputs via the data-entry keypad. If any other arbitrary function is requested, the data-entry keypad is disabled. In this case, the display line remains switched on (softkey has green background).

2nd press: The display line is switched off (softkey has grey background).

Menu *LINES-D-LINES*

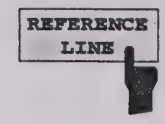


The *DISPLAY LINE 1/2* softkeys switch the display lines on/off and activate the entry of the line location.

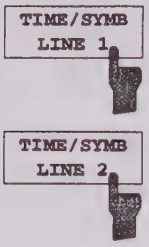
The display lines mark the selected levels in the measurement window.

The *THRESHOLD LINE* softkey switches the threshold line on/off and activates the entry of the line location.

The threshold line is a display line which defines a threshold value. This threshold value serves as a lower search limit for maximums/minimums in the marker functions (*MAX PEAK, MIN PEAK, NEXT PEAK* etc).



The *REFERENCE LINE* softkey switches the reference line on/off and activates the entry of the line position.



The *TIME/SYMB LINE 1/2* softkeys switch the time lines 1/2 on/off and activate the entry of line locations.

The time lines mark the selected times or define the search range (see section "Marker Functions").

2.4.12.2 Limit Lines – *LIMITS Key*

Limit lines are used to define amplitude curves or error boundaries on the display screen which are not to be exceeded. They indicate, for example, the upper limits for modulation errors which are permissible from a Unit Under Test (UUT). For transmission of information in TDMA (eg GSM), the amplitude of the bursts in a time slot must adhere to a curve which must fall within a specified tolerance band. The lower and upper limits may each be specified by a limit line. Then, the amplitude curve can be controlled either visually or automatically for any violations of the upper or lower limits (GO/NOGO test).
The FSE supports up to 300 limit lines, each of which may have a maximum of 50 data points. For each limit line, the following characteristics must be defined:

- The name of the limit line. The limit line can be specified for time units or symbols. Time units can be entered as followed:

absolute time

time in relation to set reference time

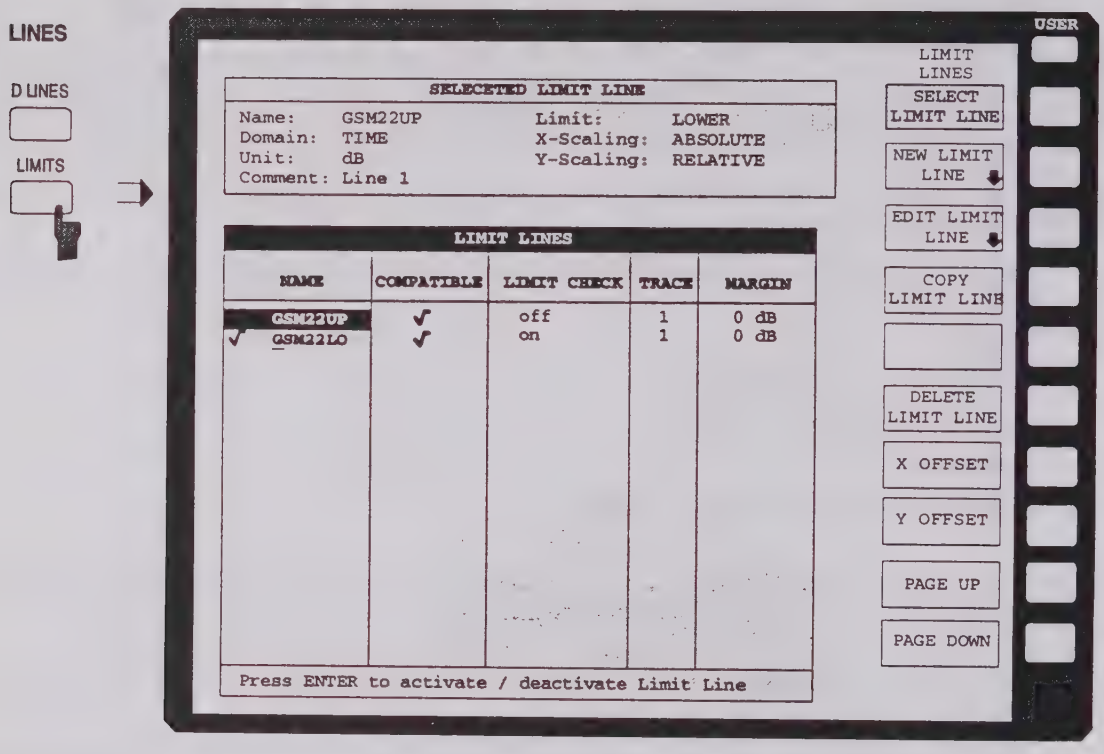
Symbols can be entered as followed:

- absolute symbols
- symbols in relation to set reference symbol

- The reference of the interpolation points to the X-axis. The limit line may be specified either for absolute times or for times which are related to the time on the left edge of the diagram.
- The reference of the interpolation points to the Y-axis. The limit line can be selected either for absolute levels or voltages or referred to the set maximum level (Ref Lvl). If the reference line is switched on, it is used as reference when relative setting has been selected.
- The type of limit line (upper or lower limit). With this information and the active limit checking function (*LIMIT CHECK softkey*), the FSE checks for compliance with each limit.
- The limit line units to be used. The units of the limit line must be compatible with the vertical axis in the active measurement window.
- The measurement curve (trace) to which the limit line is assigned. For the FSE, this defines the curve to which the limit is to be applied when several traces are simultaneously displayed.
- For each limit line, a margin can be defined which serves as a threshold for automatic evaluation.
- In addition, commentary can be written for each limit line, eg, a description of the application.

In the *LINES LIMITS* menu, the compatible limit lines can be enabled in the *LIMIT LINES* table. The *SELECTED LIMIT LINE* display field provides information concerning the characteristics of the marked limit lines. New limit lines can be specified and edited in the *NEW LIMIT LINE and EDIT LIMIT LINE* sub-menus, respectively.

. *LINES LIMIT menu*

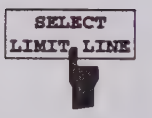


2.4.12.2.1 Limit Line Selection

The *SELECTED LIMIT LINES* table provides information about the characteristics of the marked limit line :

Name	name
Domain	domain and time
Limit	upper/lower limit
X-Scaling	absolute or relative times
Y-Scaling	absolute or relative Y-units
Unit	vertical unit
Comment	commentary

The characteristics of the limit line are set in the *EDIT LIMIT LINE (= NEW LIMIT LINE)* sub-menu.



The *SELECT LIMIT LINE* softkey activates the *LIMIT LINES* table and the selection bar jumps to the uppermost name in the table.

The columns contain the following information:

Name	Enable the limit line.
Compatible	Indicate whether the limit line is compatible with the measurement window of the given trace.
Limit Check	Activate automatic violation check for upper/lower limits.
Trace	Select the measurement curve to which the limit is assigned.
Margin	Define margin.

***Name and Compatible* - Enabling limit lines**

A maximum of 8 limit lines can be enabled at any one time. A check mark at the left edge of a cell indicates that this limit line is enabled. A limit line can only be enabled when it has a check mark in the *Compatible* column, ie only when the vertical scales are ***identical*** to those of the display in the measurement window.

Lines with the unit dB are compatible to all dB(..) settings of the Y-axis.

If the trace assigned to a line is not switched on, the line is displayed in the window the trace would be displayed in.

Example:
In split screen mode, trace 2 is assigned measuring window B. A line assigned to trace 2 is always displayed in measurement window B.

If the scale of the Y-axis is changed, all non-compatible limit lines are automatically switched off in order to avoid misinterpretation. The limit lines must be enabled anew when the original display is re-displayed.

***Limit Check* - Activate automatic limit violation check**

When *LIMIT CHECK ON* is activated, a GO/NOGO test is performed. In the center of the diagram, a display window appears which indicates the results of the limit check test:

LIMIT CHECK: PASSED	No violations of active limits.
LIMIT CHECK: FAILED	One or more active limit lines were violated. The message contains the names of the limit lines which were violated or whose margins were not complied with.
LIMIT CHECK: MARGIN	The margin of at least one active limit lines was not complied with, however, no limit line was violated. The message contains the names of the limit lines whose margins were not complied with.

The following example shows 2 active limit lines:

```
LIMIT CHECK: FAILED

LINE VHF_MASK: Failed
LINE UHF2MASK: Margin
```

A check for violations of limit lines takes place only if the limit line of the assigned measurement curve (trace) is enabled.
If *LIM CHECK* is set to *OFF* for all active limit lines, then the limit line check is not executed and the display window is activated.

***Trace* - Select the measurement curve to which the limit line is assigned.**

The selection of the measurement curve (trace) takes place in an entry window. Allowed are the integer entries 1, 2, 3 or 4. The default setting is trace 1. If the selected limit line is not compatible with the assigned measurement curve, then the limit line is disabled (display and limit check).

***Margin* - Setting a margin.**

The margin is defined as the signal-level distance to the limit line . When the limit line is defined as an upper limit, the margin means that the level is below the limit line. When the limit line is defined as a lower limit, the margin means that the level is above the limit line. The default setting is 0 dB (ie no margin).

The *COPY LIMIT LINE* softkey copies the data file describing the marked limit line and saves it under a new name. In this way, a new limit line can be easily generated by parallel translation or editing of an existing limit line. The name can be arbitrarily chosen and input via an entry window (max. of 8 characters).

The *X OFFSET* softkey activates the entry of the value for horizontally shifting a limit line which has been specified for relative times (X-axis).

The *Y OFFSET* softkey activates the entry of the value for vertically shifting a limit line, which has relative values for the Y-axis (levels or linear units such as volt).

The *DELETE LIMIT LINE* softkey erases the selected limit line. Before deletion, a message appears requesting confirmation.

The *PAGE UP* softkey sets the limit line table to the next page.

The *PAGE DOWN* softkey sets the limit line table to the previous page.

2.4.12.2.2 Entry and Editing of Limit Lines

A limit line is characterized by

- its name
- the scaling in absolute or relative times
- the vertical unit
- the vertical scaling
- the definition of the limit line as either upper or lower limit.
- the data points for time and level or modulation measurement values.

At the time of entry, the FSE immediately checks that all limit lines are in accordance with certain guidelines. These guidelines must be observed if specified operation is to be guaranteed.

- The times for each data point must be entered in ascending order, however, for any single time, two data points may be input (vertical segment of a limit line).

  The data points are allocated in order of ascending time. Gaps are not allowed. If gaps are desired, two separate limit lines must be defined and then both enabled.

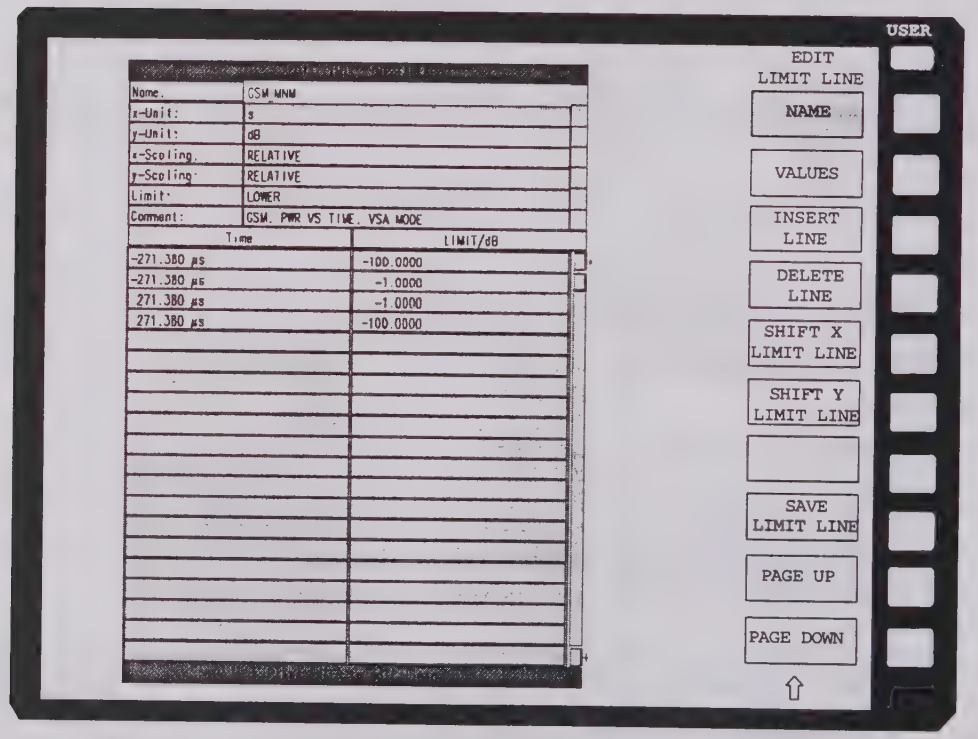
- The entered times must not necessarily be selectable in FSE. A limit line may also exceed the specified time domain sand negative times may also be entered. The allowable range is -1000 s to +1000 s.

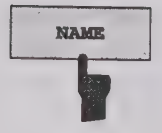
- The minimum/maximum value for a limit line is -200 dB to +200 dB for the logarithmic or 10^{-20} to 10^{+20} or-99.9% to + 999.9% for the linear amplitude scales.

LINES LIMIT-EDIT LIMIT LINE menu

The *EDIT LIMIT LINE* and *NEW LIMIT LINE* softkeys both call the *EDIT LIMIT LINE* sub-menu used for editing limit lines. In the table heading, the characteristics of the limit line can be entered. The data points for time and level values are entered in the columns.

Name	Enter name.
Domain	Indication of domain.
X-Scaling	Entry of absolute or relative values for the X-axis
Y-Scaling	Entry of absolute or relative values for the Y-axis
Unit	Select units.
Limit	Select upper/lower limit.
Comment	Enter comments.
Time	Enter time for the data points.
Limit/dBm	Enter magnitudes for the data points.





The *NAME* softkey enables the entry of characteristics in the table heading.

***Name* - Enter name**

A maximum of 8 characters are permitted for each name. All names must be compatible with the MS DOS conventions for file names. The instrument stores all limit lines with the .LIM extension.

***Domain* - Indication of domain**

Only time domain is available in vector analyzer mode.

***Unit* - Select the vertical unit for the limit line**

The selection of the unit is made in the selection box. The default setting is dBm.

***Scaling* - Select absolute or relative scaling**

The limit line can either be scaled in absolute or relative units. Any of the unit keys may be used to toggle between *ABSOLUTE* and *RELATIVE*, the cursor must be positioned in the X-*Scaling* or the *Y-Scaling* line.

X-Scaling ABSOLUTE	The times are interpreted as absolute physical units.
X-Scaling RELATIVE	In the data point table, the times are referred to the left boundary of the diagram.
Y-Scaling ABSOLUTE	The limit values refer to absolute levels or voltages.
Y-Scaling RELATIVE	The limit values refer to the reference level (Ref Level) or, in case a reference line is set, to the reference line. Limit values with the units dB or % are always relative values.

The *RELATIVE* scaling is always suitable, if masks for bursts are to be defined.
An X-offset with half the sweep time may be entered in order to shift the mask into the center of screen.

***Limit* - Select upper/lower limit**

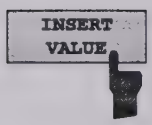
A limit line can be defined as either an upper or lower limit.

***Comment* - Enter comments**

Comments are arbitrary, however, they must be less than 40 characters long.

The *VALUES* softkey activates the entry of the data points in the table columns *Time* and *Limit/dB*..

The desired time data points are entered in ascending order (two repeated time values are permitted).



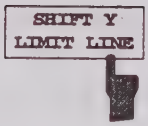
The *INSERT VALUE* softkey creates an empty line above the current cursor position where a new data point may be entered. However, during the entry of new values, it is necessary to observe an ascending order for time.

The *DELETE VALUE* softkey erases the data point (complete line) at the cursor position. All succeeding data points are shifted down accordingly.

The *SHIFT X LIMIT LINE* softkey calls an entry window where the complete limit line may be shifted parallel in the horizontal direction.

The shift takes place according to the horizontal scale in ns, µs, ms or s

In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted horizontally and stored (*SAVE LIMIT LINE* softkey) under a new name (*NAME* softkey).



The *SHIFT Y LIMIT LINE* softkey calls an entry window where the complete limit line may be shifted parallel in the vertical direction.

The shift takes place according to the vertical scale:

– for logarithmic units, relative, in dB

– for linear units, as a factor

In this manner, a new limit line can be easily generated based upon an existing limit line which has been shifted vertically and stored (*SAVE LIMIT LINE* softkey) under a new name (*NAME* softkey).

The *SAVE LIMIT LINE* softkey stores the currently edited limit line. The name can be entered in an input window (max. 8 characters)

Pressing the *PAGE UP* softkey displays the next page of data points.

Pressing the *PAGE DOWN* softkey displays the previous page of data points.

3.6 Description of Commands

3.6.1 Notation

In the following sections, all commands implemented in the instrument are first listed in tables and then described in detail, separated according to the command system. The notation corresponds to the one of the SCPI standards to a large extent. The SCPI conformity information can be taken from the individual description of the commands.

Table of Commands

Command: In the command column, the table provides an overview of the commands and their hierarchical arrangement (see indentations).

Parameter: In the parameter column the requested parameters are indicated together with their specified range.

Unit: The unit column indicates the basic unit of the physical parameters.

Remark: In the remark column an indication is made on:
- whether the command does not have a query form,
- whether the command has only one query form
- whether this command is implemented only with a certain option of the instrument

Indentations

The different levels of the SCPI command hierarchy are represented in the table by means of indentations to the right. The lower the level is, the farther the indentation to the right is. Please observe that the complete notation of the command always includes the higher levels as well.

Example: `SENSe:FREQuency:CENTer` is represented in the table as follows:

`SENSe`	first level
`:FREQuency`	second level
`:CENTer`	third level

In the individual description, the complete notation of the command is given. An example for each command is written out at the end of the individual description.

Upper/lower case notation

Upper/lower case letters serve to mark the long or short form of the key words of a command in the description (see Section 3.5.2). The instrument itself does not distinguish between upper and lower case letters.

Special characters

| A selection of key words with an identical effect exists for several commands. These key words are indicated in the same line, they are separated by a vertical stroke. Only one of these key words has to be indicated in the header of the command. The effect of the command is independent of which of the key words is indicated.

Example: `SENSe:FREQuency:CW|:FIXed`

The two following commands of identical meaning can be formed. They set the frequency of the constantly frequent signal to 1 kHz:

`SENSe:FREQuency:CW 1E3 = SENSe:FREQuency:FIXed 1E3`

A vertical stroke in indicating the parameters marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is entered.

Example: Selection of the parameters for the command

`INPut:COUPling AC | DC`

If parameter AC is selected, only the AC content is fed through, in the case of DC, the DC as well as the AC content.

[ ] Key words in square brackets can be omitted when composing the header (cf. Section 3.5.2, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
Parameters in square brackets can optionally be incorporated in the command or omitted as well.

{ } Parameters in braces can optionally be incorporated in the command either not at all, once or several times.

Description of parameters Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has specified a series of definitions therefore, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following (see also Section 3.5.5, "Parameters").

<Boolean> This indication refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword **OFF** or by the numeric value 0, the "on" state is indicated by **ON** or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value>

<num> These indications mark parameters which may be entered as numeric values or be set using specific keywords (character data).

The keywords given below are permitted:

MINimum This keyword sets the parameter to the smallest possible value.

MAXimum This keyword sets the parameter to the largest possible value.

DEFault This keyword is used to reset the parameter to its default value.

UP This keyword increments the parameter value.

DOWN This keyword decrements the parameter.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example: `SENSe:FREQuency:CENTer? MAXimum`

returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>

This keyword is provided for commands the parameters of which consist of a binary data block.

3.6.2 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. Same commands have the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands refer to the status reporting system which is described in detail in Section 3.8.

Command	Designation	Parameter	Remark
*CAL?	Calibration Query		query only
*CLS	Clear Status		no query
*ESE	Event Status Enable	0 to 255	
*ESR?	Standard Event Status Query	0 to 255	query only
*IDN?	Identification Query	<string>	query only
*IST?	Individual Status Query	0 to 255	query only
*OPC	Operation Complete		
*OPT?	Option Identification Query		query only
*PCB	Pass Control Back	0 to 30	no query
*PRE	Parallel Poll Register Enable	0 to 255	
*PSC	Power On Status Clear	0 | 1	
*RST	Reset		no query
*SRE	Service Request Enable	0 to 255	
*STB?	Status Byte Query		query only
*TRG	Trigger		no query
*TST?	Self Test Query		query only
*WAI	Wait to continue		no query

***CAL?**

CALIBRATION QUERY triggers a calibration of the instrument and subsequently query the calibration status. Any responses > 0 indicate errors.

***CLS**

CLEAR STATUS sets the status byte (STB), the standard event register (ESR) and the EVENt-part of the QUEStionable and the OPERation register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.***ESE 0 to 255**

EVENT STATUS ENABLE sets the event status enable register to the value indicated. Query *ESE? returns the contents of the event status enable register in decimal form.

***ESR?**

STANDARD EVENT STATUS QUERY returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.

***IDN?**

IDENTIFICATION QUERY queries the instrument identification.

The device response is for example: "Rohde&Schwarz, FSE, 123456, 1.03"

FSE = Device
123456 = serial number
1.03 = Firmware versions number

***IST?**

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form (0 | 1). The IST flag is the status bit which is sent during a parallel poll (cf. Section 3.8.3.2).

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register when all preceding commands have been executed. This bit can be used to initiate a service request (cf. Section 3.7).

***OPC?**

OPERATION COMPLETE QUERY writes message "1" into the output buffer as soon as all preceding commands have been executed (cf. Section 3.7).

***OPT?**

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas.

Position	Option	
1	FSE-B3	TV Demodulator
2	FSE-B4	Low Phase Noise & OCXO
3		reserved
4		reserved
5	FSE-B7	Vector Signal Analysis
6	FSE-B8	Tracking Generator 3.5 GHz
7	FSE-B9	Tracking Generator 3.5 GHz with I/Q modulator
8	FSE-B10	Tracking Generator 7 GHz
9	FSE-B11	Tracking Generator 7 GHz with I/Q modulator
10	FSE-B12	Output Attenuator for Tracking Generator
11		reserved
12		reserved

Example: `0, FSE-B4, 0, 0, FSE-B7, 0, 0, 0, FSE-B11, FSE-B12, 0, 0`

***PCB 0 to 30**

PASS CONTROL BACK indicates the controller address which the IEC-bus control is to be returned to after termination of the triggered action.

***PRE 0 to 255**

PARALLEL POLL REGISTER ENABLE sets parallel poll enable register to the value indicated. Query *PRE? returns the contents of the parallel poll enable register in decimal form.

***PSC 0 | 1**

POWER ON STATUS CLEAR determines whether the contents of the ENABle registers is maintained or reset in switching on.

*PSC = 0 causes the contents of the status registers to be maintained. Thus a service request can be triggered in switching on in the case of a corresponding configuration of status registers ESE and SRE.

*PSC 0 resets the registers.

Query *PSC? reads out the contents of the power-on-status-clear flag. The response can be 0 or 1.

***RST**

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the [PRESET] key. The default setting is indicated in the description of the commands.

***SRE 0 to 255**

SERVICE REQUEST ENABLE sets the service request enable register to the value indicated. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is triggered. Query *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

***STB?**

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

***TRG**

TRIGGER triggers all actions waiting for a trigger event (cf. Section "TRIGger subsystem", as well).

***TST?**

SELF TEST QUERY triggers all selftests of the instrument and outputs an error code in decimal form.

***WAI**

WAIT-to-CONTINUE only permits the servicing of the subsequent commands after all preceding commands have been executed and all signals have settled (cf. Section 3.7 and "*OPC" as well).

3.6.3 ABORt Subsystem

The ABORt subsystem contains the commands for aborting triggered actions. An action can be triggered again immediately after being aborted. All commands trigger events which is why they are not assigned any *RST value.

COMMAND	PARAMETER	UNIT	COMMENT
ABORt	–	–	no query

ABORt

This command aborts a current measurement and resets the trigger system.

Syntax: ABORt

Example: "ABOR;INI:IMI"

Features: *RST value: 0
SCPI: conforming

3.6.4 CALCulate Subsystem

The CALCulate subsystem contains commands for converting instrument data, transforming and carrying out corrections. These functions are carried out subsequent to data acquistion, i.e., following the SENSe subsystem.

In the split-screen representation, a distinction is made between CALCulate1 and CALCulate2:

CALCulate1 ≙ screen A;

CALCulate2 ≙ screen B

3.6.4.1 CALCulate:DELTamarker Subsystem

The CALCulate:DELTamarker subsystem checks the delta-marker functions in the instrument.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2>			
:DELTamarker<1 to 4>			
[:STATe]	<Boolean>	–	
:MODE	ABSolute|RELative		
:AOFF			no query
:TRACe	<numeric_value>	–	
:X	<numeric_value>	HZ|KHZ| MHZ|GHZ| S|MS|US|NS	
:Y?	–	–	
:MAXimum			query only
[:PEAK]	–	–	no query
:NEXT	–	–	no query
:RIGHt	–	–	no query
:LEFT	–	–	no query
:MINimum			
[:PEAK]	–	–	no query
:NEXT	–	–	no query
:RIGHt	–	–	no query
:LEFT	–	–	no query
:FUNCtion			
:FIXed			
[:STATe]	<Boolean>		
:RPOint			
:Y	<numeric_value>	DBM	
:OFFSet	<numeric_value>	DB	
:X	<numeric_value>	HZ|KHZ| MHZ|GHZ| S|MS|US|NS	
:PNOise			
[:STATe]	<Boolean>		
:RESult?	–	–	query only
:STEP			
[:INCRement]	<numeric_value>	HZ|KHZ| MHZ|GHZ| S|MS|US|NS	
:AUTO	<Boolean>	–	

CALCulate<1|2>:DELTamarker<1 to 4>[:STATe]

This command switches on or off the selected delta marker. If no indication is made, delta marker 1 is selected automatically.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>[:STATe] ON | OFF

Example: "CALC:DELT3 ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:MODE

This command switches over between relative and absolute input of frequency of the delta marker.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MODE ABSolute | RELativ

Example: "CALC:DELT:MODE ABS"

Features: *RST value: REL
SCPI: device-specific

In the RELative mode, the frequency of the delta marker is programmmed relative to the reference marker. In the ABSolute mode, the frequency is defined by the absolute values.

CALCulate<1|2>:DELTamarker<1 to 4>:AOFF

This command switches off all active delta markers.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:AOFF

Example: "CALC:DELT:AOFF"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:TRACe

This command assigns the selected delta marker to the indicated measuring curve.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:TRACe <numeric value>
<numeric value> ::= 1 to 4

Example: "CALC:DELT3:TRAC 2"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:X

This command positions the selected delta marker to the indicated frequency (span > 0) or time (span = 0).

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:X <numeric value>
<numeric value> ::= 0 to MAX (frequency) | MAX (sweep time)

Example: "CALC:DELT:X 10.7MHz"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:Y?

This command queries the value of the selected marker.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:Y?

Example: "CALC:DELT:Y?"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum[:PEAK]

This command positions the delta marker to the current maximum value in the trace memory.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum[:PEAK]

Example: "CALC:DELT:MAX"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:NEXT

This command positions the delta marker to the next smaller maximum value in the trace memory.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:NEXT

Example: "CALC:DELT:MAX:NEXT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:RIGHt

This command positions the delta marker to the next smaller maximum value to the right of the current value (i.e., in ascending X direction) in the trace memory.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:RIGHt

Example: "CALC:DELT:MAX:RIGH"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:LEFT

This command positions the delta marker to the next smaller maximum value to the left of the current value (i.e., in descending X direction) in the trace memory.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:LEFT

Example: "CALC:DELT:MAX:LEFT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MINimum[:PEAK]

This command positions the delta marker to the current minimum value in the trace memory.

Syntax: <1|2>:DELTamarker<1 to 4>:MINimum[:PEAK]

Example: "CALC:DELT:MIN"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:NEXT

This command positions the delta marker to the next higher minimum value in the trace memory.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:NEXT

Example: "CALC:DELT:MIN:NEXT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:RIGHt

This command positions the delta marker to the next higher minimum value to the right of the current value (ie in ascending X direction).

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:RIGHt

Example: "CALC:DELT:MIN:RIGH"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:LEFT

This command positions the delta marker to the next higher minimum value to the left of the current value (ie in descending X direction).

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:LEFT

Example: "CALC:DELT:MIN:LEFT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed[:STATe]

This command switches the relative measurement to a fixed reference value on or off.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed[:STATe] ON | OFF

Example: "CALC:DELT:FUNC:FIX ON"

Features: *RST value: OFF
SCPI: device-specific.

The reference value is independent of the current trace.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:Y

This command defines a new fixed reference value for the relative measurement.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:Y <numeric_value>

Example: "CALC:DELT:FUNC:FIX:RPO:X -10dBm"

Features: *RST value: - (FUNCtion:FIXed[:STATe] is set to OFF)
SCPI: device-specific

The reference value is independent of the current trace.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:Y:OFFSet

This command defines an additional level offset for the relative measurement.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:Y:OFFSet <numeric_value>

Example: "CALC:DELT:FUNC:FIX:RPO:Y:OFFS 10dB"

Features: *RST value: 0 dB
SCPI: device-specific

The level offset is included in the output of the level value.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:X

This command defines the new fixed reference frequency or time for the relative measurement.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:FIXed:RPOint:X <numeric_value>

Example: "CALC:DELT:FUNC:FIX:RPO:X 10.7MHz"

Features: *RST value: - (FUNCtion:FIXed[:STATe] is set to OFF)
SCPI: device-specific

The reference value is independent of the current trace. With span = 0, the reference time, otherwise the reference frequency is defined.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:PNOise[:STATe]

This command switches the measurement of the phase noise on or off.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:PNOise[:STATe] ON | OFF

Example: "CALC:DELT:FUNC:PNO ON"

Features: *RST value: OFF
SCPI: device-specific

When the phase noise is measured, the correction values for the bandwidth and the log amplifier are automatically considered. The measurement uses the reference values defined by FUNCtion:FIXed:RPOint:X or Y.

CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:PNOise:RESult?

This command queries the result of the phase noise measurement.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:PNOise:RESult?

Example: "CALC:DELT:FUNC:PNO:RES?"

Features: *RST value: -
SCPI: device-specific

This command is only a query which is why it is not assigned an *RST value.

CALCulate<1|2>:DELTamarker<1 to 4>:STEP[:INCRement] ß<numeric_value>

This command defines the delta marker stepwidth.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:STEP[:INCRement] <numeric_value>

Example: "CALC:DELT:STEP 10kHz" (frequency domain)
"CALC:DELT:STEP 5ms" (time domain)

Features: *RST value: - (STEP is set to AUTO)
SCPI: device-specific

CALCulate<1|2>:DELTamarker<1 to 4>:STEP:AUTO

This command switches the automatic adaption of the marker stepwidth on or off.

Syntax: CALCulate<1|2>:DELTamarker<1 to 4>:STEP:AUTO ON | OFF

Example: "CALC:DELT:STEP:AUTO OFF"

Features: *RST value: ON
SCPI: device-specific

With AUTO ON, the stepwidth is 10% of the span.

CALCulate<1|2>:THReshold:STATe

This command switches the threshold on or off.

Syntax: CALCulate:THReshold ON | OFF

Example: "CALC:THR:STAT ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:RLINe

This command defines the position of the reference line.

Syntax: CALCulate:RLINe <numeric_value>
<numeric_value>::= MINimum to MAXimum (depending on the current unit)

Example: "CALC:RLIN -10dBm"

Features: *RST value: - (STATe to OFF)
SCPI: device-specific

The reference line serves as a reference for the arithmetic operation of traces.

CALCulate<1|2>:RLINe:STATe

This command switches the reference line on or off.

Syntax: CALCulate:RLINe:STATe ON | OFF

Example: "CALC:RLIN:STAT ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:FLINe<1|2>

This command defines the position of the frequency lines.

Syntax: CALCulate:FLINe<1|2> <numeric_value>
<numeric_value>::= 0 GHz to f_{max}

Example: "CALC:FLIN2 120MHz"

Features: *RST value: - (STATe to OFF)
SCPI: device-specific

The frequency lines mark the given frequencies in the display. Frequency lines are only valid for a SPAN >0.

CALCulate<1|2>:FLINe<1|2>:STATe

This command switches the frequency line on or off.

Syntax: CALCulate:FLINe<1|2>:STATe ON | OFF

Example: "CALC:FLIN2:STAT ON"

Features: *RST value: OFF
SCPI: device-specific

3.6.4.3 CALCulate:FEED Subsystem

The CALCulate:FEED subsystem selects the measured data.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2> :FEED	<strng>		Option FSE-B7 no query

CALCulate<1|2>:FEED

This command selects the measured data that are to be displayed

Syntax: CALCulate<1|2>:FEED <string>
<string>::= 'XTIM:DDEM:MEAS' |
'XTIM:DDEM:REF' |
'XTIM:DDEM:ERR:MPH' |
'XTIM:DDEM:ERR:VECT' |
'XTIM:DDEM:SYMB' |
'TCAP'

Example: "CALC:FEED 'XTIM:DDEM:SYMB'"

Features: *RST value: 'XTIM:DDEM:MEAS'
SCPI: conforming

The string parameters have the following meaning:

'XTIM:DDEM:MEAS'	Test signal (filtered, synchronized to symbol clock)
'XTIM:DDEM:REF'	Reference signal (internally generated from demodulated test signal)
'XTIM:DDEM:ERR:MPH'	Error signal (magnitude and phase error)
'XTIM:DDEM:ERR:VECT'	Vector error signal
'XTIM:DDEM:SYMB'	Symbol table (demodulated bits and table with modulation errors)
'TCAP'	Test signal in capture buffer

3.6.4.5 CALCulate:LIMit Subsystem

The CALCulate:LIMit subsystem comprises the limit lines and the corresponding limit checks. Limit lines can be defined as upper and lower limit lines. The individual values of the limit lines correspond to the values of the X-axis (CONTrol) which have to have the same number.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2>			
:LIMit<1 to 8>			
:STATe	<Boolean>	–	
:UNIT	DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere		
:CONTrol			
[:DATA]	<numeric_value>,<numeric_value>..	HZ|S	
:DOMain	FREQuency|TIME		
:OFFSet	<numeric_value>	HZ|S	
:MODE	RELative|ABSolute		
:UPPer			
[:DATA]	<numeric_value>,<numeric_value>..	DBM	
:STATe	<Boolean>	–	
:OFFSet	<numeric_value>	DB	
:MARGin	<numeric_value>	dB	
:MODE	RELative|ABSolute	–	
:LOWer			
[:DATA]	<numeric_value>,<numeric_value>..	DBM	
:STATe	<Boolean>	–	
:OFFSet	<numeric_value>	DB	
:MARGin	<numeric_value>	dB	
:MODE	RELative|ABSolute	–	
:FAIL?			query only
:CLEar			
[:IMMediate]	–	–	no query

CALCulate<1|2>:LIMit<1 to 8>:STATe

This command switches the limit check on or off.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:STATe ON | OFF

Example: "CALC:LIM:STAT ON"

Features: *RST value: OFF
SCPI: conforming

The result of the limit check can be queried with CALCulate:LIMit:FAIL?.

CALCulate<1|2>:LIMit<1 to 8>:UNIT

This command defines the unit of the selected limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UNIT DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere

Example: "CALC:LIM:UNIT DBUV"

Features: *RST value: DBM
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:CONTrol[:DATA]

This command defines the X-axis values (frequencies or times) of the upper or lower limit lines.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:CONTrol[:DATA]
<numeric_value>,<numeric_value>..

Example: "CALC:LIM:CONT 1MHz,30MHz,300MHz,1GHz"

Features: *RST value: - (LIMit:STATe is set to OFF)
SCPI: conforming

The number of values for the CONTrol axis and the corresponding UPPer- and/or LOWer limit lines have to be identical.

CALCulate<1|2>:LIMit<1 to 8>:CONTrol:DOMain

This command defines the X-axis in the frequency or time domain.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:CONTrol:DOMain FREQuency | TIME

Example: "CALC:LIM:CONT:DOM TIME"

Features: *RST value: FREQuency
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:CONTrol:OFFSet

This command defines an offset for the X-axis value of the selected relative limit line in the frequency or time domain.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:CONTrol:OFFset <numeric_value>

Example: "CALC:LIM:CONT:OFFS 100us"

Features: *RST value: 0
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:CONTrol:MODE

This command selects the relative or absolute scaling for the X-axis of the selected limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:CONTrol:MODE RELative | ABSolute

Example: "CALC:LIM:CONT:MODE REL"

Features: *RST value: ABSolute
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:UPPer[:DATA]

This command defines the values for the upper limit lines.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UPPer[:DATA]
<numeric_value>,<numeric_value>..

Example: "CALC:LIM:UPP -10,0,0,-10"

Features: *RST value: - (LIMit:STATe is set to OFF)
SCPI: conforming

The number of values for the CONTrol axis and the corresponding UPPer limit line have to be identical. If the measured values exceed the UPPer limit line, the limit check signals errors.

CALCulate<1|2>:LIMit<1 to 8>:UPPer:STATe

This command switches the limit check with the selected limit line on or off.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UPPer:STATe ON | OFF

Example: "CALC:LIM:UPPer:STAT ON"

Features: *RST value: OFF
SCPI: conforming

The result of the limit check can be queried with CALCulate:LIMit:FAIL?.

CALCulate<1|2>:LIMit<1 to 8>:UPPer:OFFSet

This command defines an offset for the Y-axis of the selected relative upper limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UPPer:OFFset <numeric_value>

Example: "CALC:LIM:UPP:OFFS 3dB"

Features: *RST value: 0
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:UPPer:MARGin

This command defines the margin of the selected upper limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UPPer:MARGin <numeric_value>

Example: "CALC:LIM:UPP:MARGin 10dB"

Features: *RST value: 0
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:UPPer:MODE

This command selects the relative or absolute scaling for the Y-axis of the selected upper limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:UPPer:MODE RELative | ABSolute

Example: "CALC:LIM:UPP:MODE REL"

Features: *RST value: ABSolute
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:LOWer[:DATA]

This command defines the values for the selected lower limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:LOWer[:DATA] <numeric_value>,<numeric_value>..

Example: "CALC:LIM:LOW -30,-40,-40,-30"

Features: *RST value: - (LIMit:STATe is set to OFF)
SCPI: conforming

The number of values for the CONTrol axis and the corresponding LOWer limit line have to be identical. If the measured values violate the LOWer limit line, the limit check signals errors.

CALCulate<1|2>:LIMit<1 to 8>:LOWer:STATe

This command switches the limit check with the selected limit line on or off.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:LOWer:STATe ON | OFF

Example: "CALC:LIM:LOWer:STAT ON"

Features: *RST value: OFF
SCPI: conforming

The result of the limit check can be queried with CALCulate:LIMit:FAIL?.

CALCulate<1|2>:LIMit<1 to 8>:LOWer:OFFSet

This command defines an offset for the Y-axis of the selected relative lower limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:LOWer:OFFset <numeric_value>

Example: "CALC:LIM:LOW:OFFS 3dB"

Features: *RST value: 0
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:LOWer:MARGin

This command defines the margin of the selected lower limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:LOWer:MARGin <numeric_value>

Example: "CALC:LIM:LOW:MARGin 10dB"

Features: *RST value: 0
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:LOWer:MODE

This command selects the relative or absolute scaling for the Y-axis of the selected lower limit line.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:LOWer:MODE RELative | ABSolute

Example: "CALC:LIM:LOW:MODE REL"

Features: *RST value: ABSolute
SCPI: device-specific

CALCulate<1|2>:LIMit<1 to 8>:FAIL?

This command queries the result of the limit check.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:FAIL?

Example: "CALC:LIM:FAIL?"

Features: *RST value: -
SCPI: conforming

The result of the limit check responds with 0 in case of PASS and with 1 in case of FAIL.

CALCulate<1|2>:LIMit<1 to 8>:CLEar[:IMMediate]

This command deletes the result of the current limit check.

Syntax: CALCulate<1|2>:LIMit<1 to 8>:CLEar[:IMMediate]

Example: "CALC:LIM:CLE"

Features: *RST value: -
SCPI: conforming

This command is an event which is why it is not assigned an *RST value.

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2>			
:MARKer			
:STRack			
[:STATe]	<Boolean>		
:DDEMod			option FSE-B7
:RESult?	MERM | MEPK | MEPS | PERM | PEPK | PEPS |EVRM | EVPK | EVPS | IQOF | IQIM | ADR | FERR | RHO		query only
:POWer			
:RESult?	ACPower | CPOWer | OBANdwidth | OBWidth | CN | CN0		query only
:PRESet	NADC | TETRA		
:CFILter	<Boolean>		
[:STATe]	OFF		no query
:SUMMary			
:MAXimum			option FSE-B7
[:STATe]	<Boolean>		
:RESult?			query only
:PPEak			option FSE-B7
[:STATe]	<Boolean>		
:RESult?			query only
:MPEak			option FSE-B7
[:STATe]	<Boolean>		
:RESult?			query only
:MIDDle			option FSE-B7
[:STATe]	<Boolean>		
:RESult?			query only
:RMS			
[:STATe]	<Boolean>		
:RESult?			query only
:MEAN			
[:STATe]	<Boolean>		
:RESult?			query only
:PHOLd	<Boolean>		
:AVERage	<Boolean>		
:AOFF			no query

CALCulate<1|2>:MARKer<1 to 4>[:STATe]

This command switches on or off the currently selected marker. If no indication is made, marker 1 is selected automatically.

Syntax: CALCulate<1|2>:MARKer<1 to 4>[:STATe] ON | OFF

Example: "CALC:MARK3 ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:AOFF

This command switches off all active markers.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:AOFF

Example: "CALC:MARK:AOFF"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:TRACe

This command assigns the selected marker (1 to 4) to the indicated test curve.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:TRACe <numeric value>
<numeric value> ::= 1 to 4

Example: "CALC:MARK3:TRAC 2"

Features: *RST value -
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:X

This command positions the selected marker to the indicated frequency (span > 0) or time (span = 0).

Syntax: CALCulate<1|2>:MARKer<1 to 4>:X <numeric value>
<numeric value> ::= 0 to MAX (frequency) | MAX (sweep time)

Example: "CALC:MARK:X 10.7MHz"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:X:SLIMits[:STATe]

This command switches between a limited (ON) and unlimited (OFF) search range.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:X:SLIMits[STATe] ON | OFF

Example: "CALC:MARK:X:SLIM ON"

features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:COUNt

This command switches on or off the frequency counter at the marker position.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:COUNt ON|OFF

Example: "CALC:MARK:COUN ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:COUNt:RESolution

This command specifies the resolution of the frequency counter.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:COUNt:RESolution <numeric value>
<numeric value> ::= 0.1 | 1 | 10 | 100 | 1000 | 10000 Hz

Example: "CALC:MARK:COUN:RES 1kHz"

Features: *RST value: 1kHz
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:COUNt:FREQuency

This command queries the result of the frequency counter.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:COUNt:FREQuency?

Example: "CALC:MARK:COUN:FREQ?"

Features: *RST value: -
SCPI: device-specific

This command is only a query and thus has no *RST value.

CALCulate<1|2>:MARKer<1 to 4>:COUPled[:STATe]

This command switches the coupling of markers on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:COUPling[:STATe] ON | OFF

Example: "CALC:MARK:COUP ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:Y?

This command queries the selected marker value.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:Y?

Example: "CALC:MARK:Y?"

Features: *RST value: -
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:MAXimum[:PEAK]

This command positions the marker to the current maximum value in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MAXimum[:PEAK]

Example: "CALC:MARK:MAX"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MAXimum:NEXT

This command positions the marker to the next lower maximum value in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MAXimum:NEXT

Example: "CALC:MARK:MAX:NEXT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MAXimum:RIGHt

This command positions the marker to the next smaller maximum value to the right of the current value (i.e., in ascending X direction) in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MAXimum:RIGHt

Example: "CALC:MARK:MAX:RIGH"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MAXimum:LEFT

This command positions the marker to the next smaller maximum value to the left of the current value (i.e., in descending X direction) in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MAXimum:LEFT

Example: "CALC:MARK:MAX:LEFT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MINimum[:PEAK]

This command positions the marker to the current minimum value in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MINimum[:PEAK]

Example: "CALC:MARK:MIN"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MINimum:NEXT

This command positions the marker to the next higher minimum value in the trace memory.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MINimum:NEXT

Example: "CALC:MARK:MIN:NEXT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MINimum:RIGHt

This command positions the marker to the next higher minimum value to the right of the current value (ie in ascending X direction).

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MINimum:RIGHt

Example: "CALC:MARK:MIN:RIGH"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:MINimum:LEFT

This command positions the marker to the next higher minimum value to the left of the current value (ie in descending X direction).

Syntax: CALCulate<1|2>:MARKer<1 to 4>:MINimum:LEFT

Example: "CALC:MARK:MIN:LEFT"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:STEP[:INCRement]

This command defines the marker stepwidth.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:STEP[:INCRement] <numeric_value>

Example: "CALC:MARK:STEP 10kHz" (frequency domain)
"CALC:MARK:STEP 5ms" (time domain)

Features: *RST value: - (STEP is set to AUTO)
SCPI: device-specific

This command sets STEP:AUTO to OFF.

CALCulate<1|2>:MARKer<1 to 4>:STEP:AUTO

This command switches the automatic adaption of the marker stepwidth on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:STEP:AUTO ON | OFF

Example: "CALC:MARK:STEP:AUTO OFF"

Features: *RST value: ON
SCPI: device-specific

With AUTO ON, the stepwidth is 10% of the span.

CALCulate<1|2>:MARKer<1 to 4>:PEXCursion

This command defines the peak excursion.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:PEXCursion <numeric_value>

Example: "CALC:MARK:PEXC 10dB"

Features: *RST value: 6dB
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:READout

This command determines the type of the marker display.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:READout MPHase | RIMaginary

Example: "CALC:MARK:READ RIM"

Features: *RST value: -
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown

This command defines the "N dB Down" value

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown <numeric_value>

Example: "CALC:MARK:FUNC:NDBD 3dB"

Features: *RST value: 6dB
SCPI: device-specific

The temporary markers T1 and T2 are positioned by n dB below the active reference marker. The frequency spacing of these markers can be queried with CALCulate:MARKer:FUNCtion:NDBDown:RESult?.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:STATe

This command switches the "N dB Down" function on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:STATe ON | OFF

Example: "CALC:MARK:FUNC:NDBD:STAT ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:RESult?

This command queries the frequency spacing (bandwidth) of the "N dB Down" markers.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:RESult?

Example: "CALC:MARK:FUNC:NDBD:RES?"

Features: *RST value: -
SCPI: device-specific

This command is only a query which is why it is not assigned an *RST value.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:FREQuency?

This command queries the frequencies of the "N dB Down" marker.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:FREQuency?

Example: "CALC:MARK:FUNC:NDBD:FREQ?"

Features: *RST value: -
SCPI: device-specific

The two frequency values are separated by comma and indicated in ascending order. This command is only a query which is why it is not assigned an *RST value.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:ZOOM

This command defines the range to be enlarged around the active marker.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:ZOOM <numeric_value>

Example: "CALC:MARK:FUNC:ZOOM 1kHz"

Features: *RST value: -
SCPI: device-specific

The subsequent frequency sweep is stopped at the marker position and the frequency of the signal is counted. This frequency becomes the new center frequency, the zoomed span is then set. This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe[:STATe]

This command switches the noise measurement on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe[:STATe]ON | OFF

Example: "CALC:MARK:FUNC:NOIS ON"

Features: *RST value: OFF
SCPI: device-specific

The noise power density is measured at the position of the markers. The result can be queried with CALCulate:MARKer:FUNCtion:NOISe:RESult?.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe:RESult?

This command queries the result of the noise measurement.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe:RESult?

Example: "CALC:MARK:FUNC:NOIS:RES?"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:SELect

This command selects the demodulation type.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:SELect AM | FM

Example: "CALC:MARK:FUNC:DEM:SEL FM"

Features: *RST value: AM
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation[:STATe]

This command switches the demodulation on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation[:STATe] ON | OFF

Example: "CALC:MARK:FUNC:DEM ON"

Features: *RST value: OFF
SCPI: device-specific

With demodulation switched on, the frequency sweep is stopped at the marker position and the signal is demodulated during the given stop time.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:HOLDoff

This command defines the duration of the stop time for the demodulation.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:HOLDoff <num_value>
<numeric_value>::= 10ms to 1000s

Example: "CALC:MARK:FUNC:DEM:HOLD 3s"

Features: *RST value: - (DEModulation is set to OFF)
SCPI: device-specific

With demodulation switched on, the frequency sweep is stopped at the marker position and the signal is demodulated during the given stop time.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor

This command defines the shape factor measurement 60dB/6dB or 60dB/3dB.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor <expr>::=(60dB/3dB) | (60dB/6dB)

Example: "CALC:MARK:FUNC:SFAC (60dB/3dB)"

Features: *RST value: (60dB/6dB)
SCPI: device-specific

The temporary markers T1 to T4 are positioned in pairs by 60dB and by 3dB or 6dB below the active reference marker. The frequency spacing ratio of these markers - the shape factor - can be queried with CALCulate:MARKer:FUNCtion:SFACtor:RESult?.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:STATe

This command switches the shape factor measurement on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:STATe ON | OFF

Example: "CALC:MARK:FUNC:SFAC:STAT ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:RESult?

This command queries the result of the shape factor measurement.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:RESult?

Example: "CALC:MARK:FUNC:SFAC:RES?"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:FREQuncy?

This command queries the frequencies of the shape factor measurement.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:FREQuency?

Example: "CALC:MARK:FUNC:SFAC:FREQ?"

Features: *RST value: -
SCPI: device-specific

Four frequency values (at -60 dB, -6 or. -3 dB, -6 or -3 dB, -60dB) are indicated in ascending order. They are separated by a comma. This command is only a query which is why it is not assigned an *RST value.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:STRack[:STATe]

This command switches the signal-track function on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:STRack[:STATe] ON | OFF

Example: "CALC:MARK:FUNC:STR ON"

Features: *RST value: OFF
SCPI: device-specific

With SIGNAL TRACK function activated, the maximum signal is determined after each frequency sweep and the center frequency of this signal is set. With drifting signals the center frequency follows the signal.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DDEMod:RESult?

This command queries the error measurement results of digital demodulation.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DDEMod:RESult?
MERM | PERM | EVRM | IQOF | ADR | FERR

Example: "CALC:MARK:FUNC:DDEM:RES? EVRM"

Features: *RST value: -
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

MERM	magnitude error in %rms
MEPK	maximum of magnitude error in %pk
MEPS	symbol number by which the maximum of the magnitude error occured
PERM	phase error in deg
PEPK	maximum of phase error in deg
PEPS	symbol number by which the maximum of the phase error occured
EVRM	vector error in %rms
EVPK	maximum of vector error in %pk
EVPS	symbol number by which the maximum of the vector error occurred
IQOF	I/Q-offset error in %
IQIM	I/Q Imbalance in %
FERR	frequency error in Hz
ADR	amplitude drop in dB/symbol
RHO	Rho-Factor

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:RESult?

This command queries the results of the power measurement.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:RESult?
ACPower | CPOWer | OBANdwidth | OBWidth | CN | CN0

Example: "CALC:MARK:FUNC:POW:RES? ACP"

Features: *RST value: -
SCPI: device-specific

ACPower	adjacent channel power measurement
CPOWer	channel power measurement
OBANdwidth | OBWidth	occupied bandwidth power measurement
CN	signal / noise power measurement
CN0	signal-/ noise power measurement based on 1Hz bandwidth

This command is only a query which is why it is not assigned an *RST value.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer[:STATe]

This command switches the power measurement off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer[:STATe] OFF

Example: "CALC:MARK:FUNC:POW OFF"

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:PRESet

This command selects the settings for power measurement of standard NADC or of standard TETRA.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:PRESet
NADC | TETRA | PDC | PHS | CDPD | NONE

Example: "CALC:MARK:FUNC:POW:PRES NADC"

Features: *RST value: -
SCPI: device-specific

The selection of a standard influences the parameters weighting filter, channel bandwidth and spacing, resolution and video bandwidth, as well as detector and sweep time.

CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:CFILter

This command switches the weighting filter for the selected standard on or off.

Syntax: CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:CFILter ON | OFF

Example: "CALC:MARK:FUNC:POW:CFIL ON"

Features: *RST value: OFF
SCPI: device-specific

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MAXimum[:STATe

This command switches on or off the measurement of the maximum of the absolute value.

Syntax: CALCulate<1|2>:MARKer<1..4>:FUNCtion:SUMMary:MAXimum[:STATe]
ON | OFF

Example: "CALC:MARK:FUNC:SUMM:MAX ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MAXimum:RESult?

This command queries the results of the measurement of the maximum of the absolute value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MAXimum:RESult?

Example: "CALC:MARK:FUNC:SUMM:MAX:RES?"

Features: *RST value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned. The command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak[:STATe]

This command switches on or off the measurement of the positive peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak[:STATe]
ON | OFF

Example: "CALC:MARK:FUNC:SUMM:PPE ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak:RESult?

This command queries the result of the measurement of the positive peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak:RESult?

Example: "CALC:MARK:FUNC:SUMM:PPE:RES?"

Features: *RST value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned. The command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak[:STATe]

This command switches on or off the measurement of the negative peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak[:STATe]
ON | OFF

Example: "CALC:MARK:FUNC:SUMM:MPE ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak:RESult?

This command queries the result of the measurement of the negative peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak:RESult?

Example: "CALC:MARK:FUNC:SUMM:MPE:RES?"

Features: *RST- value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned. The command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle[:STATe]

This command switches on or off the measurement of the arithmetical mean between positive and negative peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle[:STATe]
ON | OFF

Example: "CALC:MARK:FUNC:SUMM:MIDD ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle:RESult?

This command queries the result of the measurement of the arithmetical mean between positive and negative peak value.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle:RESult?

Example: "CALC:MARK:FUNC:SUMM:MIDD:RES? "

Features: *RST- value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned. The command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS[:STATe]

This command switches on or off the measurement of the effective (rms) value of the total trace.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS[:STATe] ON | OFF

Example: "CALC:MARK:FUNC:SUM:RMS ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid at zero span or when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS:RESult?

This command queries the results of the rms value measurement.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS:RESult?

Example: "CALC:MARK:FUNC:SUM:RMS:RES?"

Features: *RST value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN[:STATe]

This command switches on or off the measurement of the mean value of the total trace.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN[:STATe] ON | OFF

Example: "CALC:MARK:FUNC:SUMM:MEAN ON"

Features: *RST value: OFF
SCPI: device-specific

This command is valid at zero span or when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN:RESult?

This command queries the result of the measurement of the mean value of the total trace.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN:RESult?

Example: "CALC:MARK:FUNC:SUMM:MEAN:RES?"

Features: *RST- value: -
SCPI: device-specific

This command is only a query and thus has no *RST value assigned.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PHOLd

This command switches on or off the peak-hold function.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PHOLd ON | OFF

Example: "CALC:MARK:FUNC:SUMM:PHOL ON"

Features: *RST value: OFF
SCPI: device-specific

The peak-hold function is reset by switching off and on, again. This command is valid at zero span or when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AVERage

This command switches the calculation of the average value on or off.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AVERage ON | OFF

Example: "CALC:MARK:FUNC:SUMM:AVER ON"

Features: *RST value: OFF
SCPI: device-specific

The calculation of the average is reset by switching off and on, again. This command is valid at zero span or when option FSE-B7 is fitted.

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AOFF

This command switches off all measuring functions.

Syntax: CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AOFF

Example: "CALC:MARK:FUNC:SUMM:AOFF"

Features: *RST value: –
SCPI: device-specific

This command is an <event> and therefore has no *RST value assigned and no query.

3.6.4.7 CALCulate:UNIT Subsystem

COMMAND	PARAMETER	UNIT	COMMENT
CALCulate<1|2>			
:X			Option FSE-B7
:UNIT			
:TIME	S | SYM		
:UNIT			Option FSE-B7
:ANGLe	DEG | RAD		
:POWer	DBM | V | W | DB | PCT | UNITLESS | DBPW | WATT | DBUV | VOLT | DBUA | AMPere		

CALCulate<1|2>:X:UNIT:TIME

This command selects seconds or symbols as an x-axis unit.

Syntax: CALCulate<1|2>:X:UNIT:TIME S | SYM

Example: "CALC:X:UNIT:TIME S"

Features: *RST value: _S
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>: UNIT:ANGLe

This command selects the unit for angular measurement.

Syntax: CALCulate<1|2>:UNIT:ANGLe DEG | RAD

Example: "CALC:UNIT:ANGL DEG"

Features: *RST- value: _RAD
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

CALCulate<1|2>: UNIT:POWer

This command selects the unit for power.

Syntax: CALCulate<1|2>:UNIT:POWer DBM | V | W | DB | PCT | UNITLESS | DBPW | WATT | DBUV | VOLT | DBUA | AMPere

Example: "CALC:UNIT:POW DBM"

Features: *RST value: _
SCPI: device-specific

This command is valid only when option FSE-B7 is fitted.

3.6.5 CALibration Subsystem

The commands of the CALibration subsystem perform instrument calibrations.

COMMAND	PARAMETER	UNIT	COMMENT
CALibration			
[:ALL]?	–	–	query only
:BANDwidth			
[:RESolution]?	–	–	query only
:BWIDth			
[:RESolution]?	–	–	query only
:IQ?	–	–	query only / FSE-B7 only
:LDETector?	–	–	query only
:LOSuppression?	–	–	query only
:PPEak?	–	–	query only / FSEM only
:SHORt?	–	–	query only
:STATe	<Boolean>	–	

CALibration[:ALL]?

This command performs a complete calibration of the analyzer. A "0" is returned if the calibration was successful.

Syntax: CALibration[:ALL]?

Example: "CAL?"

Features: *RST value: -
SCPI: conforming

CALibration:BANDwidth | BWIDth[:RESolution]?

This command performs a calibration of the filter bandwidths. A "0" is returned if the calibration was successful.

Syntax: CALibration:BANDwidth|BWIDth[:RESolution]?

Example: "CAL:BAND?"

Features: *RST value: -
SCPI: device-specific

CALibration:IQ?

This command performs a calibration of the option vector analyzer. A "0" is returned if the calibration was successful.

Syntax: CALibration:IQ?

Example: "CAL:IQ?"

features: *RST value: -
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

CALibration:LDETector?

This command performs a calibration of the log module's characteristic and of the detectors. A "0" is returned if the calibration was successful.

Syntax: CALibration:LDETector?

Example: "CAL:LDET?"

Features: *RST value: -
SCPI: device-specific

CALibration:LOSuppression?

This command performs a calibration of the local oscillator supression. . A "0" is returned if the calibration was successful.

Syntax: CALibration:LOSuppression?

Example: "CAL:LOS?"

Features: *RST value: -
SCPI: device-specific

This command is only valid by model '30 instruments or by instruments which have been retrofitted.

CALibration:PPEak?

This command performs a calibration of the tracking YIG filter (preselector peaking). A "0" is returned if the calibration was successful.

Syntax: CALibration:PPEak?

Example: "CAL:PPE?"

Features: *RST value: -
SCPI: device-specific

This command is only valid by the models FSEM20 and FSEM30.

CALibration:SHORt?

This command performs a short calibration. A "0" is returned if the calibration was successful.

Syntax: CALibration:SHORt?

Example: "CAL:SHOR?"

Features: *RST value: -
SCPI: device-specific

CALibration:STATe

This command determines whether (ON) or not (OFF) the current calibration data are taken into consideration.

Syntax: CALibration:STATe ON | OFF

Example: "CAL:STAT OFF"

Features: *RST value: -
SCPI: conforming

3.6.6 DIAGnostic Subsystem

The DIAGnostic subsystem contains the commands which support instrument diagnostics for maintenance, service and repair. In accordance with the SCPI standard, all of these commands are device-specific.

COMMAND	PARAMETER	UNIT	COMMENT
DIAGnostic :SERVice :INPut [:SELect] FUNCtion :NSOurce	CALibration | RF <numeric_value>,>numeric_value> <Boolean>	–	no query

DIAGnostic:SERVice:INPut[:SELect]

This command toggles between the RF input on the front panel and the internal 120-MHz reference signal.

Syntax: DIAGnostic:SERVice:INPut[:SELect] CALibration|RF

Example: `"DIAG:SERV:INP CAL"`

Features: *RST value: RF
SCPI: device-specific

DIAGnostic:SERVice:FUNCtion

This command activates a service function.

Syntax: DIAGnostic:SERVice:FUNCtion <numeric_value>,<numeric_value>...

Example: `"DIAG:SERV:FUNC 2,0,2,12,1"`

Features: *RST value: -
SCPI: device-specific

The service function is selected via five parameters: functional group number, board number, function number, parameter 1 and parameter 2.

See service manual 1065.6016.24.

DIAGnostic:SERVice:NSOurce

This command switches the 28-V supply at the rear connector of the noise source on and off.

Syntax: DIAGnostic:SERVice:NSOurce ON | OFF

Example: `"DIAG:SERV:NSO ON"`

Features: *RST value: OFF
SCPI: device-specific

3.6.7 DISPlay Subsystem

The DISPLay subsystem controls the selection and presentation of textual and graphic information as well as of trace data on the display.
The displays in the split-screen mode are assigned to WINDow 1 or 2.

COMMAND	PARAMETER	UNIT	COMMENT
DISPlay			
:FORMat	SINGle | SPLit		
.PROgram			
[:MODE]	<Boolean>		option FSE-B15
[:WINDow<1|2>]			
.TRACe<1 to 4>			
:X			
[:SCALe]			
:RVALue	<numeric_value>		option FSE-B7
:Y			
[:SCALe]	<numeric_value>	DB	
:RLEVel	<numeric_value>	DBM	
:OFFSet	<numeric_value>	DB	
:RVALue	<numeric_value>	DBM|DB|HZ|DEG|RAD	option FSE-B7
:RPOSition	<numeric_value>	PCT	option FSE-B7
:PDIVision	<numeric_value>	DBM|DB|HZ|DEG|RAD	option FSE-B7
:SPACing	LINear|LOGarithmic|PERCent	–	
:MODE	WRITe | VIEW | AVERage | MAXHold | MINHold	–	
[:STATe]	<Boolean>	–	
:SYMBol	DOTS | BARS | OFF		option FSE-B7
:EYE			
COUNt	<numeric_value>	SYM	option FSE-B7

DISPlay:FORMat SINGle | SPLit

This command switches the test result display between FULL SCREEN and SPLIT SCREEN.

Syntax: DISPlay:FORmat SINGle | SPLit

Example: "DISP:FORM SPL"

Features: *RST value: SINGle
SCPI: device-specific

DISPlay:PROGram[:MODE]

This command switches the display between the measuring instrument and the computer function.

Syntax: DISPlay:PROGram[:MODE] ON | OFF

Example: "DISP:PROG ON"

Features: *RST value: OFF
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B15 (Computer Function).

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:X[:SCALe]:RVALue

This command defines the reference value for the X-axis of the measuring diagram.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:X[:SCALe]:RVALue <numeric_value>

Example: "DISP:TRAC:X:RVAL 20SYM"

Features: *RST value: -
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]

This command defines the display range of the Y-axis (level axis) with logarithmic scaling (DISP:TRAC:Y:SPAC LOG)

For linear scaling, (DISP TRAC:Y:SPAC LIN | PERC) the display range is fixed.

Syntax: DISPlay[:WINDow<1|2>:TRACe<1 to 4>:Y[:SCALe] <numeric_value>
<numeric_value>::= 10dB to 200dB

Example: "DISP:TRAC:Y 110dB"

Features: *RST value: 100dB
SCPI: device-specific

The display range cannot be set with linear scaling (DISP:TRAC:Y:SPAC LIN | PERC).

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel

This command defines the reference level.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel <numeric_value>
<numeric_value>::= -200dBm to 200dBm

Example: "DISP:TRAC:Y:RLEV -60dBm"

Features: *RST value: -20dBm
SCPI: conforming

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel:OFFSet

This command defines the offset of the reference level.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel:OFFSet
<numeric_value>
<numeric_value>::= -200dB to 200dB

Example: "DISP:TRAC:Y:RLEV:OFFS -10dB"

Features: *RST value: 0dB
SCPI: conforming

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RVALue

This command defines the reference value for the Y-axis of the measuring diagram.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RVALue <numeric_value>

Example: "DISP:TRAC:Y:RVAL +1.20"

Features: *RST value: -
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RPOSition

This command defines the position of the reference value.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RPOSition 0 to 100PCT

Example: "DISP:TRAC:Y:RPOS 50PCT"

Features: *RST value: 100PCT
SCPI: conforming

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:PDIVision

This command defines the scaling of the Y-axis in the current unit.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:PDIVision

Example: "DISP:TRAC:Y:PDIV "

Features: *RST value: -
SCPI: conforming

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y:SPACing

This command toggles between linear and logarithmic display.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y:SPACing
LINear | LOGarithmic | PERCent

Example: "DISP:TRAC:Y:SPAC LIN"

Features: *RST value: LOGarithmic
SCPI: conforming

The linear display can be LIN/% (PERCent) or LIN/dB (LINear).

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:MODE

This command defines the type of display and the evaluation of the traces.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:MODE
WRITe | VIEW | AVERage | MAXHold | MINHold

Example: "DISP:TRAC3:MODE MAXH"

Features: *RST value: WRITe for TRACe1, STATe OFF for TRACe2 to 4
SCPI: device-specific

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:SYMBol

This command determines the display of the points of decision on the trace.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:SYMBol DOTS | BARS | OFF

Example: "DISP:TRAC:SYMB BARS"

Features: *RST value: OFF
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:EYE:COUNt

This command determines the display range of the eye diagram in symbols.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:EYE:COUNt <numeric_value>
<numeric_value> ::= 1 **to** Result Length

Example: "DISP:TRAC:EYE:COUNt 5"

Features: *RST value: 2
SCPI: device-specific

This command is only valid in conjunction with Option FSE-B7.

DISPlay[:WINDow<1|2>]:TRACe<1 to 4>[:STATe]

This command switches the display of the corresponding trace on or off.

Syntax: DISPlay[:WINDow<1|2>]:TRACe<1 to 4>[:STATe] ON | OFF

Example: "DISP:TRAC3 ON"

Features: *RST value: ON for TRACe1, OFF for TRACe2 to 4
SCPI: conforming

This command is only valid in conjunction with Option FSE-B7.

3.6.8 FORMat Subsystem

The FORMat subsystem specifies the data format of the data transmitted from and to the analyzer.

COMMAND	PARAMETER	UNIT	COMMENT
FORMat [:DATA]	ASCii|REAL|UINT[,<numeric_value>]	-	

FORMat[:DATA]

This command specifies the data format of the data transmitted from and to the analyzer.

Syntax: FORMat[:DATA] ASCii | REAL| UINT[,<numeric_value>]
<numeric_value> ::= 32

Example:
```
"FORM REAL,32"
"FORM ASC"
```

Features: *RST value: ASCii
SCPI: conforming

The data format is either ASCii or one of the formats REAL or UINT (Unsigned Integer). ASCii data are transmitted in plain text, separated by commas. REAL data are transmitted as 32-bit IEEE 754 floating-point numbers in the "definite length block". The format UINT is only used in conjunction with the option FSE-B7 for the symbol table.

The FORMat command is valid for the transmission of trace data. The data format of trace data received by the analyzer is automatically recognized, irregardless of the format which is programmed.

3.6.9 HCOPy Subsystem

The HCOPy subsystem controls the output of display information for documentation purposes on output devices or files.

COMMAND	PARAMETER	UNIT	COMMENT
HCOPy			
:ABORt	–	–	no query
:DESTination<1|2>	'SYST:COMM GPIB'| 'SYST:COMM:SER1'| 'SYST:COMM:SER2'| 'SYST:COMM:CENT'| 'MMEM'		no query
:DEVice			
:COLor	<Boolean>		
:LANGuage<1|2>	HPGL | PCL4 | PCL5 | POSTscript | ESCP | WMF| PCX | HP7470		
:PRESet<1|2>	<Boolean>		
:RESolution<1|2>	<numeric_value>		
[:IMMediate<1|2>]	–	–	no query
:ITEM			
:ALL			no query
:FFEed<1|2>			
:STATe	<Boolean>		
:LABEL			
:TEXT	<string>		
:PFEed<1|2>			
:STATe	<Boolean>		
:WINDow<1|2>			
:TABle			
:STATe	<Boolean>		
:TEXT	<string>		
:TRACe			
:STATe	<Boolean>		
:CAINcrement	<Boolean>		
:PAGE			
:DIMensions			
:QUADrant<1 to 4>			no query
:FULL			no query
:ORIentation<1|2>	LANDscape|PORTrait		

HCOPy:ABORt

This command aborts a running hardcopy output.

Syntax: HCOPy:ABORt

Example: `"HCOP:ABOR"`

Features: *RST value: -
SCPI: conforming

This command is an event which is why it is not assigned an *RST value and no query.

HCOPy:DESTination<1|2>

This command selects the interface and the configuration (1 or 2) for the hardcopy device.

Syntax: HCOPy:DESTination<1|2> "SYST:COMM:GPIB' | 'SYST:COMM:SER1' | 'SYST:COMM:SER2' | 'SYST:COMM:CENT' | 'MMEM'

Example: `"HCOP:DEST2 'SYST:COMM:SER2'"`

Features: *RST value: -
SCPI: conforming

This command is an event which is why it is not assigned an *RST value and no query.
HCOPy:DESTination 'MMEM' creates a file for the hardcopy output. Command MMEM:NAME <file_name> defines the file name.

HCOPy:DEVice:COLor

This command selects between colour and monochrome hardcopy of the screen.

Syntax: HCOPy:DEVice:COLor ON|OFF

Example: `"HCOP:DEV:COL ON"`

Features: *RST value: OFF
SCPI: conforming

HCOPy:DEVice:LANGuage<1|2>

This command determines the data format of the printout.

Syntax: HCOPy:DEVice:LANGuage HPGL| HP7470| PCL4| PCL5| POSTscript| ESCP| WMF|PCX

Example: `"HCOP:DEV:LANG WMF"`

Features: *RST value: -
SCPI: conforming

HPGL data format for outputting to a plotter in HPGL,
HP7470 special format for outputting to a plotter hp7470 (reduced HPGL format)
PCL4 and PCL5 data formats for laser and ink jet printers.
POSTscript a page description language,
ESCP data format for a 24-pin printer.
WMF (WINDOWS Metafile Format) and PCX (pixel graphics)
data formats for output files which can at a later time be directly integrated in corresponding programs for documentation purposes.

HCOPy:DEVice:PRESet<1|2>

This command resets the hardcopy unit (1 or 2) prior to generating the hardcopy.

Syntax: HCOPy:DEVice:PRESet<1|2> ON|OFF

Example: `"HCOP:DEV:PRES2 ON"`

Features: *RST value: OFF
SCPI: device-specific

HCOPy:DEVice:RESolution<1|2>

This command controls the resolution of the printout in PCL4 format (hardcopy unit 1 or 2).

Syntax: HCOPy:DEVice:RESolution<1|2> 150 | 300

Example: `"HCOP:DEV:RES 300"`

Features: *RST value: 150
SCPI: conforming

The resolution for an output in PCL4 format is between 150 dpi or 300 dpi.

HCOPy[:IMMediate<1|2>]

This command starts a hardcopy output.

Syntax: HCOPy[IMMediate<1|2>]

Example: `"HCOP"`

Features: *RST value. -
SCPI: conforming

HCOPy:IMM[1] starts the hardcopy output to device 1 (default),
HCOPy:IMM2 starts the output to device 2.
This command is an event which is why it is not assigned an *RST value and has no query.

HCOPy:DEVice:ITEM:ALL

This command selects the complete screen to be output.

Syntax: HCOPy:DEVice:ITEM:ALL

Example: `"HCOP:DEV:ITEM:ALL"`

Features: *RST value: OFF
SCPI: conforming

The hardcopy output is always provided with comments, title, time and date.

As an alternative to the whole screen, only traces (commands 'HCOPy:DEVice:WINDow:TRACe:STATe ON') or tables (command 'HCOPy:DEVice:WINDow:TABLe:STATe ON') can be output.

HCOPy:DEVice:ITEM:FFEed<1|2>:STATe

The command adds a form feed command to the hardcopy output of the screen.

Syntax: HCOPy:DEVice:ITEM:FFEed<1|2>:STATe ON|OFF

Example: `"HCOP:DEV:ITEM:FFE2:STAT ON"`

Features: *RST value: OFF
SCPI: conforming

HCOPy:DEVice:ITEM:LABel:TEXT

This command defines the title of the screen.

Syntax: HCOPy:DEVice:ITEM:LABel:TEXT <string>

Example: `"HCOP:DEV:ITEM:LAB:TEXT 'My Title'"`

Features: *RST value: OFF
SCPI: conforming

HCOPy:DEVice:ITEM:PFEed<1|2>:STATe

This command adds a paper feed command to the hardcopy output of the screen (ON).

Syntax: HCOPy:DEVice:ITEM:PFEed<1|2>:STATe ON|OFF

Example: `"HCOP:DEV:ITEM:PFE2:STAT ON"`

Features: *RST value: OFF
SCPI: device-specific

HCOPy:DEVice:ITEM:WINDow<1|2>:TABle:STATe

This command selects the output of the currently displayed tables (ON).

Syntax: HCOPy:DEVice:ITEM:WINDow<1|2>:TABle:STATe ON | OFF

Example: `"HCOP:DEV:ITEM:WIND:TABL:STAT ON"`

Features: *RST value: OFF
SCPI: device-specific

The command HCOPy:DEVice:ITEM:WINDow<1|2>:TABle:STATe OFF same as command HCOPy:DEVice:ITEM:ALL enables the output of the whole screen.

HCOPy:DEVice:ITEM:WINDow<1|2>:TEXT

This command defines the comment text for printout to trace 1 or 2.

Syntax: HCOPy:DEVice:ITEM:WINDow<1|2>:TEXT <string>

Example: `"HCOP:DEV:ITEM:WIND2:TEXT 'comment'"`

Features: *RST value: -
SCPI: device-specific

HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:STATe

This command selects the output of the currently displayed trace (ON).

Syntax: HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:STATe ON | OFF

Example: `"HCOP:DEV:ITEM:WIND:TRACe:STAT ON"`

Features: *RST value: OFF
SCPI: device-specific

The command HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:STATe OFF same as command HCOPy:DEVice:ITEM:ALL enables the output of the whole screen.

HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:CAINcrement

The command automatically changes the colour of the currently displayed trace after printout (ON).

Syntax: HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:CAINcrement ON | OFF

Example: `"HCOP:DEV:ITEM:WIND:TRACe:CAIN ON"`

Features: *RST value: OFF
SCPI: device-specific

The automatic change of colour of the trace allows outputting to a plotter of several traces of the same diagram. For a better distinction, the colour of the trace is changed ("Color Auto Increment").

HCOPy:PAGE:DIMensions:QUADrant

The command defines the quadrant which is allocated to the screen output.

Syntax: HCOPy.PAGE.DIMensions:QUADrant<1 to 4>

Example: `"HCOP:PAGE:DIM:QUAD1"`

Features: *RST value: -
SCPI: conforming

The quadrants are defined as QUAD1 at the top right, QUAD2 at the top left, QUAD3 at the bottom left and QUAD4 at the bottom right. This command is an event which is why it is not assigned an *RST value and has no query.

HCOPy:PAGE:DIMensions:FULL

This command defines that the full screen is to be printed out.

Syntax: HCOPy:PAGE:DIMensions:FULL

Example: `"HCOP:PAGE:DIM:FULL"`

Featrues: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned and *RST value and has no query.

HCOPy:PAGE:ORIentation<1|2>

The command selects the format of the output (portrait and landscape) (hardcopy unit 1 or 2).

Syntax: HCOPy:PAGE:ORIentation<1|2> LANDscape | PORTrait

Example: `"HCOP:PAGE:ORI LAND"`

Features: *RST value: -
SCPI: conforming

3.6.10 INITiate Subsystem

The INITiate subsystem checks the initialization of the trigger subsystem.

COMMAND	PARAMETER	UNIT	COMMENT
INITiate			
:CONTinuous	<boolean>	–	
[:IMMediate]	–	–	no query
:DISPlay	<boolean>	–	

INITiate:CONTinuous

This command determines if the trigger system is continuously initiated ("Free Run").

Syntax: INITiate:CONTinuous ON | OFF

Example: `"INIT:CONT OFF"`

Features: *RST value: ON
SCPI: conforming

Setting "INITiate:CONTinuous ON" corresponds to function SWEEP CONTinuous, ie the sweep of the analyzer is cyclically repeated. The setting "INITiate:CONTinuous OFF" corresponds to function SWEEP SINGLE.

INITiate[:IMMediate]

The command initiates a new sweep or starts a single sweep.

Syntax: INITiate[:IMMediate]

Example: `"INIT"`

Features: *RST value: -
SCPI: conforming

This command is an event which is why it is not assigned an *RST value and has no query.

INITiate:DISPlay

This command switches the display on or off during a single sweep.

Syntax: INITiate:DISPlay ON | OFF

Example: `"INIT:DISP OFF"`

Features: *RST value: ON
SCPI: device-specific

3.6.11 INPut Subsystem

The INPut subsystem checks the input features of the instrument.

COMMAND	PARAMETER	UNIT	COMMENT
INPut			
:ATTenuation	<numeric_value>	DB	
:AUTO	<Boolean>	–	
:MODE	NORMal | LNOise|LDIStortion	–	
:UPORt<1|2>			
[:VALue?]	–	–	query only
:STATe	<Boolean>	–	
:IMPedance	50 | 75	OHM	
:CORRection	RAM | RAZ		
:MIXer	<numeric_value>	DBM	

INPut:ATTenuation

This command programs the input attenuator.

Syntax: INPut:ATTenuation <numeric_value>
<numeric_value>::= 0 to 70dB

Example: `"INP:ATT 40dB"`

Features: *RST value: - (AUTO is set to ON)
SCPI: conforming

The input attenuator can be programmed in steps of 10dB. If the attenuation is directly programmed, the coupling to the reference level is switched off.

INPut:ATTenuation:AUTO

This command automatically couples the input attenuation to the reference level.

Syntax: INPut:ATTenuation:AUTO ON | OFF

Example: `"INP:ATT:AUTO ON"`

Features: *RST value: ON
SCPI: conforming

INPut:ATTenuation:AUTO:MODE

This command optimizes the coupling of the input attenuation to the reference level to high sensitivity or to high intermodulation immunity.

Syntax: INPut:ATTenuation:AUTO:MODE NORMal | LNOise | LDIStortion

Example: `"INP:ATT:AUTO:MODE LDIS"`

Features: *RST value: ON
SCPI: device-specific

For LNOise, the input attenuator value is set 10dB lower than for INP:ATT:AUTO:MODE NORMal, for LDIStortion it is set 10dB higher.

INPut:UPORt<1|2>[:VALue]?

This command queries the control lines of the user ports.

Syntax: INPut:UPORt<1|2>[:VALue]?

Example: `"INP:UPOR2?"`

Features: *RST value: -
SCPI: device-specific

This command is a query command which is why it is not assigned an *RST value.

INPut:UPORt<1|2>:STATe

This commmand toggles the control lines of the user ports between INPut and OUTPut.

Syntax: INPut:UPORt<1|2>:STATe ON | OFF

Example: `"INP:UPOR2:STAT ON"`

Features: *RST value: ON
SCPI: device-specific

With ON, the user port is switched to INPut, with OFF to OUTPut.

INPut:IMPedance

This command sets the nominal input impedance of the analyzer.

Syntax: INPut:IMPedance 50 | 75

Example: `"INP:IMP 75"`

Features: *RST value: 50
SCPI: conforming

Switching the input impedance to 75 Ω includes the matching elements RAM or RAZ selected by the command INPut:IMPedance:CORRection.

INPut:IMPedance:CORRection

This command selects the matching element for 75 Ω input impedance.

Syntax: INPut:IMPedance:CORRection RAM | RAZ

Example: `"INP:IMP:CORR RAM"`

Features: *RST value: - (INPut:IMPedance = 50 Ω)
SCPI: device-specific

INPut:MIXer

This command defines the nominal mixer level of the analyzer.

Syntax: INPut:MIXer <numeric value>

Example: `"INP:MIX -30"`

Features: *RST value: -
SCPI: device-specific

3.6.12 INSTrument Subsystem

The INSTrument subsystem selects the operating mode of the unit either via text parameters or fixed numbers.

COMMAND	PARAMETER	UNIT	COMMENT
INSTrument<1|2> [:SELect] :NSELect	SANalyzer | DDEMod <numenc_value>		Option FSE-B7

INSTrument[:SELect]

This command switches between the spectrum analyzer and vector analyzer mode by means of text parameters.

Syntax: INSTrument[:SELect] SANalyzer | DDEMod

Example: `"INST DDEM"`

Features: *RST value: SANalyzer
SCPI: conforming

Switchover to DDEMod is only possible in conjunction with Option FSE-B7.

INSTrument:NSELect

This command switches between the two modes by means of numbers.

Syntax: INSTrument:NSELect 1 | 2

Example: `"INST:NSEL 2"`

Features: *RST value: 1
SCPI: conforming

Value 1 corresponds to SANalyzer, value 2 corresponds to DDEMod of the command INSTrument[:SELect].

3.6.13 MMEMory Subsystem

The MMEMory (mass memory) subsystem provides commands which allow for access to the storage media of the instrument and for storing and loading various instrument settings.
The NAMe command stores the HCOPy outputs in a file.
The various drives can be addressed via the mass storage unit specifier <msus> using the conventional DOS syntax. The internal hard disk is addressed by "C:", the floppy-disk drive installed by "A:".
The file names <file_name> are indicated as string parameters with the commands being enclosed in quotation marks. They correspond to the DOS conventions.
DOS file names consist of max. 8 ASCII characters and an extension of up to three characters separated from the file name by a colon " " Both, the colon and the extension are optional. The colon is not part of the file name. DOS file names do not differ between uppercase and lowercase notation. All letters and digits are permitted as well as the special characters "_", "^", "$", "~", "!", "#", "%", "&", "-", "{", "}", "(", ")", "@" and "`". Reserved file names are CLOCK$, CON, AUX, COM1 to COM4, LPT1 to LPT3, NUL and PRN.
The two characters "*" and "?" have the function of so-called "wildcards", i.e., they are variables for selection of several files. The question mark "?" replaces exactly one character which may be any, the asterisk means any of the remaining characters in the file name. "*.*" thus means all files in a directory.

COMMAND	PARAMETER	UNIT	COMMENT
MMEMory			
:CDIRectory	<directory_name>	–	
:COPY	<file_name>,<file_name>	–	no query
:DELete	<file_name>	–	no query
:INITialize	<msus>	–	no query
:LOAD			
:STATe	1,<file_name>	–	
:MDIRectory	<directory_name>	–	no query
:MOVE	<file_name>,<file_name>	–	no query
:MSIS	<msus>	–	
:NAME	<file_name>	–	
:RDIRectory	<directory_name>	–	no query
:STORe			
:STATe	1,<file_name>	–	

MMEMory:CDIRectory

This command changes the current directory.

Syntax: MMEMory:CDIRectory <directory_name>
<directory_name>::= DOS path name

Example: "MMEM:CDIR 'C:\USER\DATA'"

Features: *RST value: -
SCPI: conforming

In addition to the path name, the indication of the directory may contain the drive name. The path name complies with the DOS conventions.

MMEMory:COPY

This command copies the files indicated.

Syntax: MMEMory:COPY <file_source>,<file_destination>
<file_source>,<file_destination> ::= <file_name>
<file_name> ::= DOS file name

Example: "MMEM:COPY 'C:\USER\DATA\SETUP.CFG','A:'"

Features: *RST value: -
SCPI: conforming

The indication of the file name may include the path and the drive. The file names and path information must be in accordance with the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:DELete

This command deletes the files indicated.

Syntax: MMEMory:DELete <file_name>
<file_name> ::= DOS file name

Example: "MMEM:DEL 'TEST01.HCP'"

Features: *RST value: -
SCPI: conforming

The indication of the file name contains the path and, optionally, the drive. Indication of the path corresponds to the DOS conventions. The file name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:INITialize

This command formats the disk in drive A.

Syntax: MMEMory:INITialize <msus>
<msus> ::= 'A:'

Example: "MMEM:INIT 'A:'"

Features: *RST value: -
SCPI: conforming

Formatting deletes all data stored on the floppy disk. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:LOAD:STATe

This command loads instrument settings from files.

Syntax: MMEMory:LOAD:STATe 1,<file_name>
<file_name> ::= DOS file name

Example: "MMEM:LOAD:STAT 1,'A:TEST.CFG'"

Features: *RST value: -
SCPI: conforming

The contents of the file is loaded and set as new instrument state. The file name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:MDIRectory

This command creates a new directory

Syntax: MMEMory:MDIRectory <directory_name>
<directory_name>::= DOS path name

Example: "MMEM:MDIR 'C:\USER\DATA'"

Features: *RST value: -
SCPI: device-specific

The file name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:MOVE

This command renames existing files.

Syntax: MMEMory:MOVE <file_source>,<file_destination>
<file_source>,<file_destination> ::= <file_name>
<file_name> ::= DOS file name

Example: "MMEM:MOVE 'TEST01.CFG','SETUP.CFG'"

Features: *RST value: -
SCPI: conforming

The file name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:MSIS

This command changes to the drive indicated.

Syntax: MMEMory:MSIS <device>
<device>::= 'A:' | 'C:'

Example: "MMEM:MSIS 'A:'"

Features: *RST value: "C:'
SCPI: conforming

The drive may be the internal hard disk C: or the floppy-disk drive A:. The drive is indicated according to the DOS conventions.

MMEMory:NAME

This command specifies a file which is printed or plotted to.

Syntax: MMEMory:NAME <file_name>
<file_name> ::= DOS filename

Example: "MMEM:NAME 'PLOT1.HPG'"

Features: *RST value: -
SCPI: conforming

The file name includes indication of the path and may also include the drive. The file name and path information correspond to the DOS conventions. The output to the printer is routed into a file using the command "HCOP:DEST 'MMEM'".

MMEMory:RDIRectory

This command deletes the directory indicated.

Syntax: MMEMory:RDIRectory <directory_name>
<directory_name>::= DOS path name

Example: "MMEM:RDIR 'C:\TEST'"

Features: *RST value: -
SCPI: device-specific

The directory name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

MMEMory:STORe:STATe

This command stores the current instrument setting in a file.

Syntax: MMEMory:STORe:STATe 1,<file_name>
<file_name> ::= DOS file name

Example: "MMEM:STOR:STAT 1,'TEST.CFG'"

Features: *RST value: -
SCPI: conforming

The current instrument state is stored as a file. The file name includes indication of the path and may also include the drive. The path name corresponds to the DOS conventions. This command is an event which is why it is not assigned an *RST value and has no query.

3.6.14 OUTPut Subsystem

Das OUTPut subsystem checks the output features of the instrument.

COMMAND	PARAMETER	UNIT	COMMENT
OUTPut			
[:STATe]	<boolean>	–	option FSE-B8 to B11
:UPORt<1|2>			
[:VALue]	<binary>	–	
:STATe	<boolean>	–	

OUTPut[:STATe]

This command switches the tracking generator on or off.

Syntax: OUTPut:[:STATe] ON | OFF

Example: `"OUTP ON"`

Features: *RST value: -
SCPI: conforming

This command is only valid in conjunction with one of the options FSE-B8 to FSE-B11.

OUTPut:UPORt<1|2>[:VALue

This command sets the control lines of the user ports.

Syntax: OUTPut:UPORt<1|2>[:VALue] <binary>
<Binary>::= 00000000 to 11111111

Example: `"OUTP:UPOR2 10100101"`

Features: *RST value: -
SCPI: device-specific

User port 1 or 2 is written with the given binary pattern. If the user port is programmed to INPut instead of OUTPut, the output value is temporarily stored.

OUTPut:UPORt<1|2>:STATe

This command toggles the control lines of the user ports between INPut and OUTPut.

Syntax: OUTPut:UPORt<1|2>:STATe ON | OFF

Example: `"OUTP:UPOR:STAT ON"`

Features: *RST value: OFF
SCPI: device-specific

With ON, the user port is switched to OUTPut, with OFF to INPut.

3.6.15 SENSe Subsystem

The SENSe subsystem is itself divided up into several subsystems. The commands of these subsystems directly control device-specific settings, they do not refer to the signal characteristics of the measurement signal.
The SENSe subsystem controls the essential parameters of the analyzer. In accordance with the SCPI standard, it is for this reason optional, which means that it is not necessary to include the SENSe node in command sequences.

3.6.15.1 [SENSe]:AVERage Subsystem

The [SENSe]:AVERage subsystem calculates the average of the data acquired. A new test result is obtained from various successive measurements. The amount of test points and the axis reference of the new result correspond to those of the original measurements.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:AVERage			
:COUNt	<numeric_value>	–	
:AUTO	<Boolean>	–	
[:STATe]	<Boolean>	–	
:TYPE	MAXimum | SCALar	–	

[SENSe]:AVERage:COUNt

The command specifies the number of measurements which are combined.

Syntax: [SENSe]:AVERage:COUNt <numeric_value>
<numeric value> ::= 0 to 256

Example: ":AVER:COUN 16"

Features: *RST value: 0
SCPI: conforming

[SENSe]:AVERage:COUNt:AUTO

AUTO ON selects a suitable number of :COUNt for the respective type of measurement.

Syntax: [SENSe]:AVERage:COUNt:AUTO ON | OFF

Example: ":AVER:COUN:AUTO ON"

Features: *RST value: OFF
SCPI: conforming

[SENSe]:AVERage[:STATe]

The command switches on or off the average function.

Syntax: [SENSe]:AVERage[:STATe] ON | OFF

Example: ":AVER OFF"

Features: *RST value: OFF
SCPI: conforming

[SENSe]:AVERage:TYPE

The command selects the type of average function.

Syntax: [SENSe]:AVERage:TYPE MAXimum | SCALar

Example: ":AVER:TYPE SCAL"

Features: *RST value: SCALar
SCPI: conforming

The following average functions have been defined:

MAXimum: $AVG(n) = MAX(X_1 \text{ to } X_n)$

SCALar: $$AVG(n) = \frac{1}{n} \times \sum_{i=1}^{n} xi$$

3.6.15.2 SENSe:BANDwidth Subsystem

This subsystem controls the setting of the analyzer's filter bandwidths. Both groups of commands (BANDwidth and BWIDth) perform the same functions.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:BANDwidth			
[:RESolution]	<numeric_value>	HZ	
:AUTO	<Boolean>	-	
:MODE	ANALog | DIGital		
:VIDeo	<numeric_value>	HZ	
:AUTO	<Boolean>	-	
:BWIDth			
[:RESolution]	<numeric_value>	HZ	
:AUTO	<Boolean>	-	
:MODE	ANALog | DIGital		
:VIDeo	<numeric_value>	HZ	
:AUTO	<Boolean>	-	

[SENSe:]BANDwidth|BWIDth[:RESolution]

This command defines the analyzer's resolution bandwidth.

Syntax: [SENSe:]BANDwidth|BWIDth[:RESolution] <numeric_value>
<numeric_value>::= 10Hz to 10MHz (model 20)
1HZ to 10MHz (model 30)

Example: `"BAND 1MHz"`

Features: *RST value: - (AUTO is set to ON)
SCPI: conforming

The values for the resolution bandwidth are rounded in 1 | 2 | 3 | 5 steps. Bandwidths >1kHz are always analog bandwidths, bandwidths <1kHz are always realized digitally. For the bandwidth 1kHz, it is possible to select either analog or digital filters.

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO

This command either automatically couples the resolution bandwidth of the analyzer to the span or cancels the coupling.

Syntax: [SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO ON | OFF

Example: `"BAND:AUTO OFF"`

Features: *RST value: ON
SCPI: conforming

The automatic coupling matches the resolution bandwidth to the currently set span according to the relationship between span and resolution bandwidth.

[SENSe:]BANDwidth|BWIDth[:RESolution]:MODE

This command toggles between analog and digital resolution filters for the 1-kHz bandwidth.

Syntax: [SENSe:]BANDwidth|BWIDth[:RESolution]:MODE ANALog | DIGital

Example: `"BAND:MODE DIG"`

Features: *RST value: ANALog
SCPI: device-specific

Depending on the bandwidth, the resolution filters are automatically toggled between digital filters . (<1kHz) and analog filters (>1kHz) The 1-kHz bandwidth is present in the instrument as a digital filter and as an analog filter and can be toggled using this command.

[SENSe:]BANDwidth|BWIDth:VIDeo

This command defines the analyzer's video bandwidth.

Syntax: [SENSe:]BANDwidth|BWIDth:VIDeo <numeric_value>
<numeric_value>::= 1Hz to 10MHz

Example: `"BAND:VID 10kHz"`

Features: *RST value: - (AUTO is set to ON)
SCPI: conforming

The values for the video bandwidth are rounded in 1 | 2 | 3 | 5 steps.

[SENSe:]BANDwidth|BWIDth:VIDeo:AUTO

This command either automatically couples the analyzer's video bandwidth to the resolution bandwidth or cancels the coupling.

Syntax: [SENSe:]BANDwidth|BWIDth:VIDeo:AUTO ON | OFF

Example: `"BAND:VID:AUTO OFF"`

Features: *RST value: ON
SCPI: conforming

3.6.15.3 SENSe:DETector Subsystem

The SENSe:DETector subsystem controls the recording of measurement values via the type of detector selected for each trace.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe] :DETector [:FUNCtion] :AUTO	APEak | NEGative| POSitive | SAMPle| RMS | AVERage <Boolean>	–	

[SENSe:]DETector[:FUNCtion]

This command switches the detector for recording of the measured value.

Syntax: [SENSe:]DETector[:FUNCtion] APEak |NEGative | POSitive | SAMPle | RMS | AVERage

Example: `"DET POS"`

Features: *RST value: APEak
SCPI: conforming

The value "APEak" (AutoPeak) displays both the postive peak value and the negative peak value when noise is present. The positive peak value is displayed when one signal is present.

[SENSe:]DETector[:FUNCtion]:AUTO

This command either couples the detector to the current trace setting or turns coupling off.

Syntax: [SENSe:]DETector[:FUNCtion]:AUTO ON | OFF

Example: `"DET:AUTO OFF"`

Features: *RST value: ON
SCPI: conforming

3.6.15.4 SENSe:DDEMod Subsystem

This subsystem controls the parameters for digital demodulation and is only active in conjunction with Option FSE-B7.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:DDEMod			Option FSE-B7
:FORMat	QPSK | PSK | MSK | QAM | FSK		
:QPSK			
:FORMat	NORMal | DIFFerential | OFFSet | DPI4		
:PSK			
NSTate	2 | 8		
:FORMat	NORMal | DIFFerential		
:MSK			
:FORMat	TYPE1 | TYPE2 | NORMal | DIFFerential		
:QAM			
:NSTate	16		
:FSK			
:NSTate	2 | 4		
:SRATe	<numeric_value>	HZ	
:TIMe	<numeric_value>	SYM	
:PRATe	1 | 2 | 4 | 8 | 16		
:FILTer			
:MEASurement	OFF | RCOSine | RRCosine | GAUSsian		
:REFerence	RCOSine | RRCosine | GAUSsian		
:ALPHa	<numeric_value>		
:NORMalize	<Boolean>		
:PRESet	GSM | NADC | TETRa | DCS1800 | PCS1900 | PHS | PDC | CDPD		
:SEARch			
:PULSe			
:STATe	<Boolean>		
:SYNC			
:OFFSet	<numeric_value>	SYM	
:PATTern	<string>		
:STATe	<Boolean>		
:TIME	100 | 200 | 400 | 800	SYM	
:TCAPture			Option FSE-B7
:LENGth	<numeric_value>		

[SENSe:]DDEMod:FORMat

This command selects the digital demodulation type.

Syntax: [SENSe:]DDEMod:FORMat QPSK | PSK | MSK | QAM | FSK

Example: `"DDEM:FORM QPSK"`

Features: *RST value: MSK
SCPI: device-specific

[SENSe:]DDEMod:QPSK:FORMat:

This command determines the specific demodulation type for QPSK.

Syntax: [SENSe:]DDEMod:QPSK:FORMat NORMal | DIFFerential | OFFSet | DPI4

Example: `"DDEM:QPSK:FORM DPI4"`

Features: *RST value: -
SCPI: device-specific

[SENSe:]DDEMod:PSK:NSTate

This command determines the specific demodulation type for PSK.

Syntax: [SENSe:]DDEMod:PSK:NSTate 2 | 8

Example: `"DDEM:PSK:NST 2"`

Features: *RST value: -
SCPI: device-specific

Value 2 (ie PSK2) corresponds to BPSK demodulation, value 8 the 8PSK demodulation.

[SENSe:]DDEMod:PSK:FORMat

This command determines the specific demodulation type for PSK.

Syntax: [SENSe:]DDEMod:PSK:FORMat NORMal | DIFFerential

Example: `"DDEM:PSK:FORM DIFF"`

Features: *RST value: -
SCPI: device-specific

[SENSe:]DDEMod:MSK:FORMat | NORMal | DIFFerential

This command determines the specific demodulation type for MSK.

Syntax: [SENSe:]DDEMod:MSK:FORMat TYPE1 | TYPE2 | NORMal | DIFFerential

Example: `"DDEM:MSK:FORM TYPE2"`

Features: *RST value: TYPE2 | DIFFerential
SCPI: device-specific

TYPE1 | NORMal corresponds to MSK demodulation, TYPE2 | DIFFerential corresponds to DMSK demodulation

[SENSe:]DDEMod:FSK:NSTate:

This command determines the specific demodulation type for FSK.

Syntax: [SENSe:]DDEMod:FSK:NSTate 2 | 4

Example: `"DDEM:FSK:NST 2"`

Features: *RST- value: -
SCPI: device-specific

[SENSe:]DDEMod:SRATe

This command defines the symbol rate.

Syntax: [SENSe:]DDEMod:SRATe <numeric_value>
<numeric value> ::= 160 Hz to 1.6 MHz

Example: `"DDEM:SRAT 18kHz"`

Features: *RST value: 270.833333kHz
SCPI: device-specific

[SENSe:]DDEMod:TIME

The command determines the number of displayed symbols (result length).

Syntax: [SENSe:]DDEMod:TIME <numeric_value>
<numeric value> ::= 1 to Frame Length

Example: `"DDEM:TIME 80"`

Features: *RST value: 147
SCPI: device-specific

[SENSe:]DDEMod:PRATe

This command determines the number of points per symbol.

Syntax: [SENSe:]DDEMod:PRATe 1 | 2 | 4 | 8 | 16

Example: `"DDEM:PRAT 8"`

Features: *RST value: 4
SCPI: device-specific

[SENSe:]DDEMod:FILTer:MEASurement

This command selects the input filter for the test signal.

Syntax: [SENSe:]DDEMod:FILTer:MEASurement
OFF | RCOSine | RRCosine | GAUSsian

Example: `"DDEM:FILT:MEAS RCOS"`

Features: *RST value: OFF
SCPI: device-specific

[SENSe:]DDEMod:FILTer:REFerence

This command selects the input filter for the reference signal.

Syntax: [SENSe:]DDEMod:FILTer:REFerence
RCOSine | RRCosine | GAUSsian

Example: `"DDEM:FILT:REF RCOS"`

Features: *RST value: GAUSsian
SCPI: device-specific

[SENSe:]DDEMod:FILTer:ALPHa

This command determines the filter characteristic (ALPHA/BT).

Syntax: [SENSe:]DDEMod:FILTer:ALPHa <numeric_value>
<numeric_value>::= 0.2 to 1 (stepwidth 0.05)

Example: `"DDEM:FILT:ALPH 0.5"`

Features: *RST value: 0.3
SCPI: device-specific

[SENSe:]DDEMod:NORMalize

This command switches normalizing of the unit circle on or off using IQ offset.

Syntax: [SENSe:]DDEMod:NORMalize ON | OFF

Example: `"DDEM:NORM OFF"`

Features: *RST value: ON
SCPI: device-specific

[SENSe:]DDEMod:SEARch:PULSe:STATe

This command switches the signal burst search on or off.

Syntax: [SENSe:]DDEMod:SEARch:PULSe:STATe ON | OFF

Example: `"DDEM:SEAR:PULS:STAT OFF"`

Features: *RST value: ON
SCPI: device-specific

[SENSe:]DDEMod:SEARch:SYNC:OFFSet

This command defines the offset of the display with reference to the sychronization sequence.

Syntax: [SENSe:]DDEMod:SEARch:SYNC:OFFSET <numeric_value>

Example: `"DDEM:SEAR:SYNC:OFFS 10SYM"`

Features: *RST value: 0 SYM
SCPI: device-specific

[SENSe:]DDEMod:SEARch:SYNC:PATTern

This command defines the synchronization sequence.

Syntax: [SENSe:]DDEMod:SEARch:SYNC:PATTern <string>

Example: `"DDEM:SEAR:SYNC:PATT "1101001"`

Features: *RST value: ""
SCPI: device-specific

[SENSe:]DDEMod:SEARch:SYNC:STATe

This command switches the search for a synchronization sequence on or off.

Syntax: [SENSe:]DDEMod:SEARch:SYNC:STATe ON | OFF

Example: `"DDEM:SEARch:SYNC:STAT ON"`

Features: *RST value: OFF
SCPI: device-specific

[SENSe:]DDEMod:SEARch:TIME

This command determines the number of symols required for demodulation (frame length). The value 800 is only permissible if the number of points per symbol is <16.

Syntax: [SENSe:]DDEMod:SEARch:TIME 100 | 200 | 400 | 800

Example: `"DDEM:SEAR:TIME 800"`

Features: *RST value: 200
SCPI: device-specific

[SENSe:]DDEMod:PRESet

This command selects an automatic setting of all modulation parameters according to a standard transmission method.

Syntax: [SENSe:]DDEMod:PRESet GSM | NADC | TETRa | DCS1800 | PCS1900 | PHS | PDC | CDPD

Example: `"DDEM:PRES TETR"`

Features: *RST value: GSM
SCPI: device-specific

[SENSe:]TCAPture:LENGth

This command determines the number of sampling points that are written into the memory for each measurement (memory size).

Syntax: [SENSe:]TCAPture:LENGth 1024 | 2048 | 4096 | 8192 | 16384

Example: `"TCAP:LENG 1024"`

Features: *RST value: 16384
SCPI: device-specific

3.6.15.5 SENSe:FREQuency Subsystem

The SENSe:FREQuency subsystem defines the frequency axis of the active display. The frequency axis can either be defined via the start/stop frequency or via the center frequency and span.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:FREQuency			
:CENTer	<numenc_value>	HZ	
:LINK	STARt | STOP | SPAN	–	
:STEP	<numenc_value>	HZ	
:LINK	SPAN | RBW	–	
:FACTor	<numenc_value>	–	
:SPAN	<numenc_value>	HZ	
:FULL	–	–	
:LINK	CENTer | STARt | STOP	–	
:STARt	<numenc_value>	HZ	
:LINK	CENTer | STOP | SPAN	–	
:STOP	<numenc_value>	HZ	
:LINK	CENTer | STAR t |SPAN	–	

[SENSe:]FREQuency:CENTer

This command defines the center frequency of the analyzer.

Syntax: [SENSe:]FREQuency:CENTer <numeric_value>
<numeric_value>::= 0 GHz to f_{max}

Example: `"FREQ:CENT 100MHz"`

Features: *RST value: f_{max} / 2
SCPI: conforming

The automatic coupling of the parameters is set to SPAN FIXED.

[SENSe:]FREQuency:CENTer:LINK

This command defines the coupling of the center frequency to the start, stop frequency or the frequency span.

Syntax: [SENSe:]FREQuency:CENTer:LINK STARt | STOP | SPAN

Example: `"FREQ:CENT:LINK STAR"`

Features: *RST value: SPAN
SCPI: device-specific

[SENSe:]FREQuency:CENTer:STEP

This command defines the stepwidth of the center frequency.

Syntax: [SENSe:]FREQuency:CENTer:STEP <numeric_value>
<numeric_value>::= 0 to f_{max}

Example: `"FREQ:CENT:STEP 120MHz"`

Features: *RST value: - (AUTO 0.1 × SPAN is switched on)
SCPI: conforming

[SENSe:]FREQuency:CENTer:STEP:LINK

This command couples the stepwidth of the center frequency to span (span >0) or to the resolution bandwidth (span = 0).

Syntax: [SENSe:]FREQuency:CENTer:STEP:LINK SPAN | RBW

Example: `"FREQ:CENT:STEP:LINK SPAN"`

Features: *RST value: SPAN
SCPI: device-specific

[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor

This command couples the stepwidth of the center frequency with a factor to the span (span >0) or to the resolution bandwidth (span = 0).

Syntax: [SENSe:]FREQuency:CENTer:STEP:LINK:FACTor <numeric_value>
<numeric_value>::= 1 to 100 PCT

Example: `"FREQ:CENT:STEP:LINK:FACT 20PCT"`

Features: *RST value: - (AUTO 0.1 × SPAN is switched on)
SCPI: device-specific

[SENSe:]FREQuency:SPAN

This command defines the frequency span of the analyzer.

Syntax: [SENSe:]FREQuency:SPAN <numeric_value>
<numeric_value>::= 0 GHz to f_{max}

Example: `"FREQ:SPAN 10MHz"`

Features: *RST value: f_{max}
SCPI: conforming

The automatic coupling of the parameters is set to CENTER FIXED.

[SENSe:]FREQuency:SPAN:FULL

This command sets the maximum frequency span of the analyzer.

Syntax: [SENSe:]FREQuency:SPAN:FULL

Example: `"FREQ:SPAN:FULL"`

Features: *RST value: -
SCPI: conforming

This command is an event which is why it is not assigned an *RST value and has no query.

[SENSe:]FREQuency:SPAN:LINK

This command defines the coupling for frequency-span changes.

Syntax: [SENSe.]FREQuency:SPAN:LINK CENTer | START | STOP

Example: `"FREQ:SPAN:LINK STOP"`

Features: *RST value: CENTer
SCPI: conforming

[SENSe:]FREQuency:STARt

This command defines the start frequency of the analyzer.

Syntax: [SENSe:]FREQuency:STARt <numeric_value>
<numeric_value>::= 0 GHz to f_{max}

Example: `"FREQ:STAR 20MHz"`

Features: *RST value: 0
SCPI: conforming

The automatic coupling of the parameters is set to STOP FIXED.

[SENSe:]FREQuency:STARt:LINK

This command defines the coupling for start-frequency changes.

Syntax: [SENSe:]FREQuency:STARt:LINK CENTer | STOP | SPAN

Example: `"FREQ:STAR:LINK SPAN"`

Features: *RST value: STOP
SCPI: device-specific

[SENSe:]FREQuency:STOP

This command defines the stop frequency of the analyzer.

Syntax: [SENSe:]FREQuency:STOP <numeric_value>
<numeric_value>::= 0 GHz to f_{max}

Example: "FREQ:STOP 2000MHz"

Features: *RST value: f_{max}
SCPI: conforming

The automatic coupling of the parameters is set to STARt FIXED.

[SENSe:]FREQuency:STOP:LINK

This command defines the coupling for stop-frequency changes.

Syntax: [SENSe:]FREQuency:STOP:LINK CENTer | STARt | SPAN

Example: "FREQ:STOP:LINK SPAN"

Features: *RST value: STARt
SCPI: device-specific

3.6.15.6 SENSe:POWer Subsystem

This subsystem controls the setting of the analyzer's power measurements.

Command	Parameter	Unit	Comment
[SENSe<1|2>]			
:POWer			
:ACHannel			
:SPACing			
[:UPPer]	<numeric_value>	HZ	
:ACPairs	1 | 2 | 3		
:BANDwidth	<numeric_value>	HZ	
:BWIDth	<numeric_value>	HZ	
:MODE	ABSolute | RELative		
:REFerence			
:AUTO	ONCE		no query
:PRESet	ACPower | CPOWer | OBANdwidth | OBWidth | CN | CN0		
:BANDwidth	<numeric_value>	PCT	
:BWIDth	<numeric_value>	PCT	

[SENSe:]POWer:ACHannel:SPACing[:UPPer]

This command defines the channel spacing of adjacent channel to carrier.

Syntax: [SENSe:]POWer:ACHannel:SPACing[:UPPer] <numeric_value>
<numeric_value>::= 0 Hz to 1000 MHz

Example: `"POW:ACH:SPAC 28kHz"`

Features: *RST value: 24 kHz
SCPI: conforming

[SENSe:]POWer:ACHannel:ACPairs

This command sets the number of adjacent channels (upper and lower channel in pairs).

Syntax: [SENSe:]POWer:ACHannel:ACPairs 1.| 2 | 3

Example: `"POW:ACH:ACP 3"`

Features: *RST value: 1
SCPI: device-specific

[SENSe:]POWer:ACHannel:BANDwidth|BWIDth

This command sets the channel bandwidth of the radio communication system.

Syntax: [SENSe:]POWer:ACHannel:BANDwidth|BWIDth <numeric_value>
<numeric_value>::= 0 Hz to 1000 MHz

Example: `"POW:ACH:BWID 30kHz"`

Features: *RST value: 24 kHz
SCPI: device-specific

[SENSe:]POWer:ACHannel:MODE

This command toggles between absolute and relative measurement.

Syntax: [SENSe:]POWer:ACHannel:MODE ABSolute | RELative

Example: `"POW:ACH:MODE REL"`

Features: *RST value: ABSolute
SCPI: device-specific

For the relative measurement the reference value is set to the currently measured channel power by command POW:ACH:REF:AUTO ONCE.

[SENSe:]POWer:ACHannel:REFerence:AUTO

This command sets the reference value to the currently measured channel power.

Syntax: [SENSe:]POWer:ACHannel:REFerence:AUTO ONCE

Example: `"POW:ACH:REF:AUTO ONCE"`

Features: *RST value: -
SCPI: device-specific

This command is an event which is why it is not assigned an *RST value and has no query.

[SENSe:]POWer:ACHannel:PRESet

This command selects the type of power mesurement.

Syntax: [SENSe:]POWer:ACHannel:PRESet
ACPower | CPOWer | OBANdwidth|OBWidth | CN | CN0

Example: `"POW:ACH:REF:PRES ACP"`

Features: *RST value: -
SCPI: device-specific

[SENSe:]POWer:BANDwidth|BWIDth

This command defines the percentage of the power with respect to the total power.

Syntax: [SENSe:]POWer:ACHannel:BANDwidth|BWIDth 0 to 100PCT

Example: `"POW:BWID 95PCT"`

Features: *RST value: 99PCT
SCPI: device-specific

This value defines the occupied bandwidth (measurement POW:ACH:PRES OBW).

3.6.15.7 SENSe:ROSCillator Subsystem

This subsystem controls the reference oscillator.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:ROSCillator			
:SOURce	INTernal | EXTernal	–	
:EXTernal			
FREQuency	<numeric_value>	HZ	

[SENSe:]ROSCillator:SOURce

This command controls selection of the reference oscillator.

Syntax: [SENSe:]ROSCillator:SOURce INTernal | EXTernal

Example: `"ROSC:SOUR EXT"`

Features: *RST value: INTernal
SCPI: conforming

If the external reference oscillator is selected, the reference signal must be connected to the rear panel of the instrument.

[SENSe:]ROSCillator:EXTernal:FREQuency

This command defines the frequency of the external reference oscillator.

Syntax: [SENSe:]ROSCillator:EXTernal:FREQuency <numeric_value>
<numeric_value>::= 1MHz to 16MHz

Example: `"ROSC:EXT:FREQ 5MHz"`

Features: *RST value: 10MHz
SCPI: conforming

The value of the external reference frequency (1MHz to 16MHz) is rounded in steps of 1MHz.

3.6.15.8 SENSe:SWEep Subsystem

This subsystem controls the sweep parameters.

COMMAND	PARAMETER	UNIT	COMMENT
[SENSe]			
:SWEep			
:TIME	<numeric_value>	S	
:AUTO	<Boolean>	–	
:COUNt	<numeric_value>	–	
:EGATe	<Boolean>	–	
:LEVel	<numeric_value>	V	
:TYPE	LEVel|EDGE	–	
:POLarity	POSitive|NEGative	–	
:HOLDoff	<numeric_value>	S	
:LENGth	<numeric_value>	S	
:SOURce	EXTernal | RFPower	–	
:GAP	<Boolean>	–	
:PRETrigger	<numeric_value>	S	
:TRGTogap	<numeric_value>	S	
:LENGth	<numeric_value>	S	

[SENSe:]SWEep:TIME

This command defines the duration of the sweep.

Syntax: [SENSe:]SWEep:TIME <numeric_value>
<numeric_value>::= 5ms to 1000s

Example: `"SWE:TIME 10s"`

Features: *RST value - (AUTO is set to ON)
SCPI: conforming

If SWEep:TIME is directly programmed, automatic coupling is switched off.

[SENSe:]SWEep:TIME:AUTO

This command switches the automatic coupling of the sweep time for the frequency span or bandwidth settings.

Syntax: [SENSe:]SWEep:TIME:AUTO ON | OFF

Example: `"SWE:TIME:AUTO ON"`

Features: *RST value: ON
SCPI: conforming

If SWEep:TIME is directly programmed, automatic coupling is switched off.

[SENSe:]SWEep:COUNt

This command defines the number of sweeps started with single sweep.

Syntax: [SENSe:]SWEep:COUNt <numeric_value>
<numeric_value>::= 0 to 32767

Example: "SWE:COUNT 64"

Features: *RST value: 0
SCPI: conforming

This parameter defines the number of sweeps or the number of averagings. In the average mode, the value 0 defines a running averaging of measurement data over 10 sweeps.

[SENSe:]SWEep:EGATe

This command controls the sweep with the external gate signal.

Syntax: [SENSe]SWEep:EGATe ON | OFF

Example: "SWE:EGAT ON"

Features: *RST value: OFF
SCPI: device-specific

[SENSe:]SWEep:EGATe:LEVel

This command determines the threshold for the extenal gate signal.

Syntax: [SENSe:]SWEep:EGATe:LEVel <numeric_value>
<numeric_value>::= -5V to +5V

Example: "SWE:EGAT:LEV 3V"

Features: *RST value: 2V
SCPI: device-specific

If SWEep:TIME is directly programmed, automatic coupling is switched off.

[SENSe:]SWEep:EGATe:TYPE

This command sets the type of triggering (level or edge) by the external gate signal.

Syntax: [SENSe:]SWEep:EGATe:TYPE LEVel | EDGE

Example: "SWE:EGAT:TYPE EDGE"

Features: *RST value: LEVel
SCPI: device-specific

Parameter EGATe:LENGth is not used for level triggering.

[SENSe:]SWEep:EGATe:POLarity

This command determines the polarity of the external gate signal.

Syntax: [SENSe:]SWEep:EGATe:POLarity POSitive | NEGative

Example: `"SWE:EGAT:POL POS"`

Features: *RST value: NEGative
SCPI: device-specific

[SENSe:]SWEep:EGATe:HOLDoff

This command defines the delay time between the external gate signal and the continuation of the sweep.

Syntax: [SENSe:]SWEep:EGATe:HOLDoff <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"SWE:EGAT:HOLD 100us"`

Features: *RST value: 0s
SCPI: device-specific

The values for the delay time can be set in steps 1, 2, 3 and 5.

[SENSe:]SWEep:EGATe:LENGth

In case of edge triggering, this command determines the time interval in which the analyzer sweeps.

Syntax: [SENSe:]SWEep:EGATe:LENGth <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"SWE:EGAT:LENG 10ms"`

Features: *RST value: 0s
SCPI: device-specific

The values for the delay time can be set in steps 1, 2, 3 and 5.

[SENSe:]SWEep:EGATe:SOURce

This command toggles between external gate signal and RF power signal.

Syntax: [SENSe:]SWEep:EGATe:SOURce EXTernal | RFPower

Example: `"SWE:EGAT:SOUR RFP"`

Features: *RST value: EXTernal
SCPI: device-specific

[SENSe:]SWEep:GAP

This command controls the operating mode GAP SWEEP.

Syntax: [SENSe:]SWEep:GAP ON | OFF

Example: `"SWE:GAP ON"`

Features: *RST value: OFF
SCPI: device-specific

Operating mode GAP SWEEP for measurements in the time domain controls the display of measured values. Measured values can be blanked for a defined time range (GAP).

[SENSe:]SWEep:GAP:PRETrigger

This command defines the evaluation time for measured values before the pretrigger time.

Syntax: [SENSe:]SWEep:GAP:PRETrigger <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"SWE:GAP:PRET 100us"`

Features: *RST value: 0s
SCPI: device-specific

The pretrigger time can be programmed from 0 to 100s with a resolution of max. 50 ns.

[SENSe:]SWEep:GAP:TRGTogap

This command defines the time between the pretrigger time and the beginning of the gap (trigger-to-gap time)

Syntax: [SENSe:]SWEep:GAP:TRGTogap <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"SWE:GAP:TRGT 50us"`

Features: *RST value: 0s
SCPI: device-specific

The TRIGGER-TO-GAP time can be programmed from 0 to 100s with a resolution of max. 50 ns.

[SENSe:]SWEep:GAP:LENGth

This command defines the gap length.

Syntax: [SENSe:]SWEep:GAP:LENGth <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"SWE:GAP:LENG 400us"`

Features: *RST value: 0s
SCPI: device-specific

The gap length can be programmed from 0 to 100s in steps of 1, 2, 3 and 5.

3.6.16 SOURce - Subsystem

The SOURce subsystem controls the output signals of the analyzer. Dies sind insbesondere die Einstellungen des Tracking-Generators (options FSE-B8 to FSE-B11).

Command	Parameter	Unit	Comment
SOURce			option FSE-B8 to FSE-B12
:AM			
:STATe	<boolean>		
:DM			
:STATe	<boolean>		option FSE-B9 / FSE-B11
:FM			
:STATe	<boolean>		
:FREQuency			
:OFFSet	<numenc_value>	HZ	
:POWer			
:ALC			
:SOURce	INTernal | EXTernal		
[:LEVel]			
[:IMMediate]			
[:AMPLitude]	<numeric_value>	DBM	
:OFFSet	<numeric_value>	DB	

SOURce:AM:STATe

This command switches on or off the external amplitude modulation of the tracking generator.

Syntax: SOURce:AM:STATe ON | OFF

Example: `"SOUR:AM:STAT ON "`

Features: *RST-value: OFF
SCPI: conforming

External AM, external FM und external DM is switched off, if active.

SOURce:DM:STATe

This command switches on or off the external delta modulation of the tracking generator.

Syntax: SOURce:DM:STATe ON | OFF

Example: `"SOUR:DM:STAT ON "`

Features: *RST- value: OFF
SCPI: conforming

External AM, external ALC und external frequency offset are switched off, if active.

SOURce:FM:STATe

This command switches on or off the external frequency modulation of the tracking generator.

Syntax: SOURce:FM:STATe ON | OFF

Example: `"SOUR:FM:STAT ON "`

Features: *RST-value: OFF
SCPI: conforming

External AM, external ALC, external delta modulation and frequency offset are switched off, if active.

SOURce:FREQuency:OFFSet

This command defines a frequency offset of the tracking generators to the current analyzer frequency.

Syntax: SOURce:FREQuency:OFFSet <numeric value>
<numeric value>::= -200MHz .. 200MHz

Example: "SOUR:FREQ:OFFS "

Features: *RST-value: 0 Hz
SCPI: conforming

External delta modulation is switched off, if active.

SOURce:POWer:ALC:SOURce

This command switches on or off the external level control (ALC).

Syntax: SOURce:POWer:ALC:SOURce INTernal | EXTernal

Example: "SOUR:POW:ALC:SOUR INT "

Features: *RST- value: INT
SCPI: conforming

External AM and external delta modulation are switched off, if active.

SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]

This command defines the level of the tracking generator.

Syntax: SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <numeric value>

<numeric value>::= -20dBm ... 0dBm / Option FSE-B12: -90dBm ... 0dBm

Example: "SOUR:POW -20dBm"

Features: *RST- value:
SCPI: conforming

SOURce:POWer[:LEVel][:IMMediate]:OFFSet

This command defines a level offset for the tracking generator.

Syntax: SOURce:POWer[:LEVel][:IMMediate]:OFFSet <numeric value>
<numeric value>::= -200dB ... +200dB

Example: "SOUR:POW:OFFS -10dB"

Features: *RST- value: 0dB
SCPI: conforming

3.6.17 STATus Subsystem

The STATus subsystem contains the commands for the status-reporting system (see Section 3.8, Status Reporting System"). *RST does not influence the status registers.

COMMAND	PARAMETER	UNIT	COMMENT
STATus			
:OPERation			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:PRESet	–	–	
:QUEStionable			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:POWer			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:LIMit			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:LMARgin			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:SYNC			
[:EVENt?]	–	–	
:CONDition?	–	–	
:ENABle	0 to 65535	–	
:PTRansition	0 to 65535	–	
:NTRansition	0 to 65535	–	
:QUEue?	–	–	
[:NEXT?]	–	–	

STATus:OPERation[:EVENt?]

This command queries the contents of the EVENt section of the STATus:OPERation register.

Syntax: STATus:OPERation[:EVENt?]

Example: `"STAT:OPER?"`

Features: *RST value: –
SCPI: conforming

The contents of the EVENt section is deleted with readout.

STATus:OPERation:CONDition?

This command queries the CONDition section of the STATus:OPERation register.

Syntax: STATus OPERation.CONDition?

Example: `"STAT:OPER:COND?"`

Features: *RST value: –
SCPI: conforming

Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

STATus:OPERation:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register.

Syntax: STATus:OPERation:ENABle 0 to 65535

Example: `"STAT:OPER:ENAB 65535"`

Features: *RST value: –
SCPI: conforming

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:OPERation:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:OPERation:PTRansition 0 to 65535

Example: `"STAT:OPER:PTR 65535"`

Features: *RST value: –
SCPI: conforming

STATus:OPERation:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Syntax: STATus:OPERation:NTRansition 0 to 65535

Example: `"STAT:OPER:NTR 65535"`

Features: *RST value: –
SCPI: conforming

STATus:PRESet

This command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e., all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e., a transition from 1 to 0 in a CONDition bit is not detected. The ENABle part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e., all events in these registers are not passed on.

Syntax: STATus:PRESet

Example: `"STAT:PRES"`

Features: *RST value –
SCPI. conforming

STATus:QUEStionable[:EVENt?]

This command queries the contents of the EVENt section of the STATus:QUEStionable register.

Syntax: STATus:QUEStionable[:EVENt?]

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: conforming

Readout deletes the contents of the EVENt section.

STATus:QUEStionable:CONDition?

This command queries the CONDition section of the STATus:QUEStionable register.

Syntax: STATus:QUEStionable:CONDition?

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: conforming

Readout does not delete the contents of the CONDition section.

STATus:QUEStionable:ENABle

This command sets the bits of the ENABle section of the STATus-QUEStionable register.

Syntax: STATus:QUEStionable:ENABle 0 to 65535

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: conforming

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:QUEStionable:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:PTRansition 0 to 65535

Example: `"STAT:QUES:PTR 65535"`

Features: *RST value: –
SCPI: conforming

STATus:QUEStionable:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:NTRansition 0 to 65535

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: conforming

STATus:QUEStionable:POWer[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:POWer register.

Syntax: STATus:QUEStionable:POWer[:EVENt?]

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: conforming

Readout deletes the contents of the EVENt section.

STATus:QUEStionable:POWer:CONDition?

This command queries the content of the CONDition section of the STATus:QUEStionable:POWer register.

Syntax: STATus:QUEStionable:POWer:CONDition?

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: conforming

Readout does not delete the contents of the CONDition section.

STATus:QUEStionable:POWer:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable:POWer register.

Syntax: STATus:QUEStionable:POWer:ENABle 0...65535

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: conforming

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:QUEStionable:POWer:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:POWer register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:POWer:PTRansition 0...65535

Example: `"STAT:QUES:PTR 65535"`

Features: *RST-value: –
SCPI: conforming

STATus:QUEStionable:POWer:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:POWer register from 1 to 2 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:POWer:NTRansition 0...65535

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: conforming

STATus:QUEStionable:LIMit[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:LIMit register.

Syntax: STATus:QUEStionable:LIMit[:EVENt?]

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: device-specific

Readout deletes the contents of the EVENt section.

STATus:QUEStionable:LIMit:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:LIMit register.

Syntax: STATus:QUEStionable:LIMit:CONDition?

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: device-specific

Readout does not delete the contents of the CONDition section.

STATus:QUEStionable:LIMit:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register.

Syntax: STATus:QUEStionable:LIMit:ENABle 0...65535

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: device-specific

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:QUEStionable:LIMit:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LIMit register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:LIMit:PTRansition 0...65535

Example: `"STAT:QUES:PTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEStionable:LIMit:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable:LIMit register from 1 to 2 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:LIMit:NTRansition 0...65535

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEStionable:LMARgin[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:LMARgin register.

Syntax: STATus:QUEStionable:LMARgin[:EVENt?]

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: device-specific

Readout deletes the contents of the EVENt section.

STATus:QUEStionable:LMARgin:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:LMARgin register.

Syntax: STATus:QUEStionable:LMARgin:CONDition?

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: device-specific

Readout does not delete the contents of the CONDition section.

STATus:QUEStionable:LMARgin:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable:LMARgin register.

Syntax: STATus:QUEStionable:LMARgin:ENABle 0...65535

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: device-specific

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:QUEStionable:LMARgin:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable: LMARgin register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:LMARgin:PTRansition 0...65535

Example: `"STAT:QUES:PTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEStionable:LMARgin:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable: LMARgin register from 1 to 2 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:LMARgin:NTRansition 0...65535

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEStionable:SYNC[:EVENt]?

This command queries the contents of the EVENt section of the STATus:QUEStionable:SYNC register.

Syntax: STATus:QUEStionable:SYNC[:EVENt?]

Example: `"STAT:QUES?"`

Features: *RST value: –
SCPI: device-specific

Readout deletes the contents of the EVENt section.

STATus:QUEStionable:SYNC:CONDition?

This command queries the contents of the CONDition section of the STATus:QUEStionable:SYNC register.

Syntax: STATus:QUEStionable:SYNC:CONDition?

Example: `"STAT:QUES:COND?"`

Features: *RST value: –
SCPI: device-specific

Readout does not delete the contents of the CONDition section.

STATus:QUEStionable:SYNC:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable: SYNC register.

Syntax: STATus:QUEStionable:SYNC:ENABle 0...65535

Example: `"STAT:QUES:ENAB 65535"`

Features: *RST value: –
SCPI: device-specific

The ENABle register selectively enables the individual events of the associated EVENt section for the sum bit in the status byte.

STATus:QUEStionable:SYNC:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 0 to 1 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:SYNC:PTRansition 0...65535

Example: `"STAT:QUES:PTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEStionable:SYNC:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable: SYNC register from 1 to 2 for the transitions of the CONDition bit.

Syntax: STATus:QUEStionable:SYNC:NTRansition 0...65535

Example: `"STAT:QUES:NTR 65535"`

Features: *RST value: –
SCPI: device-specific

STATus:QUEue[:NEXT?]

This command queries the earliest entry to the error queue, thus deleting it.

Syntax: STATus:QUEue[:NEXT?]

Example: `"STAT:QUE?"`

Features: *RST value: –
SCPI: conforming

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI (cf. Appendix B). If the error queue is empty, the error number 0, "no error", is returned. This command is identical with the command `SYSTem:ERRor`.

3.6.18 SYSTem Subsystem

This subsystem comprises a series of commands for general functions.

COMMAND	PARAMETER	UNIT	COMMENT
SYSTem			
:COMMunicate			
:GPIB			
[:SELF]			
:ADDRess	0 to 30	–	
:RDEVice<1|2>			
:ADDRess	0 to 30	–	
:RTERminator	LFEoi | EOI		
:SERial<1|2>			
:CONTrol			
:DTR	IBFull | OFF		
:RTS	IBFull | OFF		
[:RECeive]		–	
:BAUD	<numeric_value>	–	
:BITS	7 | 8		
:PARity			
[:TYPE]	EVEN | ODD | NONE	–	
:SBITs	1 | 2		
:PACE	XON | NONE	–	
:DATE	<num>, <num>, <num>	–	query only
:ERRor?	–		
:PASSword			
[:CENable]	<string>	–	
:PRESet	–		
:SPEaker		–	
:VOLume	<numeric_value>	–	query only
:TIME	0 to 23, 0 to 59, 0 to 59	–	
:VERSion?	–		no query

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess

This command changes the IEC/IEEE-bus address of the unit.

Syntax: SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 0 to 30

Example: `"SYST:COMM:GPIB:ADDR 18"`

Features: *RST value: - (no influence on this parameter)
SCPI: conforming

SYSTem:COMMunicate:GPIB[:SELF]:RTERminator

This command changes the delimiter.

Syntax: SYSTem:COMMunicate:GPIB[:SELF]:RTERminator LFEOI | EOI

Example: `"SYST:COMM:GPIB:RTERM EOI"`

Features: *RST value: LFEOI
SCPI: device-specific

The analyzer contains a DMA-channel for communication via IEC-bus. This ensures maximum speed for the transfer of commands and data. The parser for command decoding integrated in the instrument is, however, only activated by the delimiter when the command is completely transfered. In order to make this possible for the transfer of binary data, too (e. g. trace data which are retransfered into the instrument), the delimiter recognition must be switched to the EOI signal prior to the transfer. Output of binary data from the instrument does not require such a switching.

SYSTem:COMMunicate:GPIB:RDEVice<1|2>:ADDRess

This command changes the IEC/IEEE-bus address of the unit which is selected as hardcopy device 1 or 2, provided that the IEC/IEEE-bus interface of this unit is set as an interface.

Syntax: SYSTem:COMMunicate:GPIB:RDEVice<1|2>:ADDRess 0 to 30

Example: `"SYST:COMM:GPIB:RDEV2:ADDR 5"`

Features: *RST value: 4
SCPI: conforming

SYSTem:COMMunicate:SERial<1|2>:CONTrol:DTR
SYSTem:COMMunicate:SERial<1|2>:CONTrol:RTS

These commands switch the hardware handshake procedure for the given serial interface off (OFF) or on (IBFull).

Syntax: SYSTem:COMMunicate:SERial<1|2>:CONTrol:DTR IBFull | OFF
SYSTem:COMMunicate:SERial<1|2>:CONTrol:RTS IBFull | OFF

Examples: `"SYST:COMM:SER:CONT:DTR OFF"`
`"SYST:COMM:SER2:CONT:RTS IBF"`

Features: *RST value: OFF
SCPI: conforming

The two commands have the same meaning. SERial1 and SERial 2 correspond to device COM1and COM2, respectively.

SYSTem:COMMunicate:SERial<1|2>[:RECeive]:BAUD

This command sets the transmission speed for the given serial interface.

Syntax: SYSTem:COMMunicate:SERial<1|2>[:RECeive:]BAUD <numeric_value>
<numeric_value>::= 75 | 150 | 300 | 600 | 1200 | 2400 | 9600

Example: `"SYST:COMM:SER:BAUD 2400"`

Features: *RST value: 9600
SCPI: conforming

SERial1 and SERial 2 correspond to device interface COM1 and COM2, respectively. Permissible values are 75 Baud, 150 Baud, 300 Baud, 600 Baud, 1200 Baud, 2400 Baud, 4800 Baud, 9600 Baud.

SYSTem:COMMunicate:SERial<1|2>[:RECeive]:BITS

This command defines the number of data bits per data word for the given serial interface.

Syntax: SYSTem:COMMunicate:SERial<1|2>[:RECeive]:BITS 7 | 8

Example: `"SYST:COMM:SER2:BITS 7"`

Features: *RST value: 8
SCPI: conforming

SERial1 and SERial 2 correspond to device interface COM1 and COM2, respectively.

SYSTem:COMMunicate:SERial<1|2>[:RECeive]:PARity[:TYPE]

This command defines the parity check for the given serial interface.

Syntax: SYSTem:COMMunicate:SERial<1|2>:RECeive:PARity[:TYPE]
EVEN | ODD | NONE

Example: `"SYST:COMM:SER:PAR EVEN"`

Features: *RST value: NONE
SCPI: conforming

SERial1 and SERial 2 correspond to device interface COM1 and COM2, respectively. Permissible values are:

EVEN even Parity
ODD odd Parity
NONE no parity check.

SYSTem:COMMunicate:SERial<1|2>[:RECeive]:SBITs

This command defines the number of stopbits per data word for the given serial interface.

Syntax: SYSTem:COMMunicate:SERial<1|2>[:RECeive]:SBITs 1|2

Example: `"SYST:COMM:SER:SBITs 2"`

Features: *RST value: 1
SCPI: conforming

SERial1 and SERial 2 correspond to device interface COM1 and COM2, respectively.

SYSTem:COMMunicate:SERial<1|2>[:RECeive]:PACE

This command switches on or off the software handshake für for the given serial interface.

Syntax: SYSTem:COMMunicate:SERial<1|2>[:RECeive]:PACE XON | NONE

Example!: `"SYST:COMM:SER:PACE XON"`

features: *RST value: NONE
SCPI: conforming

SERial1 and SERial 2 correspond to device interface COM1 and COM2, respectively.

SYSTem:DATE

This command is used to enter the date for the internal calendar.

Syntax: SYSTem:DATE <num>,<num>,<num>
<num>,<num>,<num> ::= 1980 to 2099, 1 to 12, 1 to 31

Example: `" SYST:DATE 1994,12,1"`

Features: *RST value: –
SCPI: conforming

The sequence of entry is year, month, day.

SYSTem:ERRor?

This command queries the earliest entry to the error queue, thus deleting it.

Syntax: SYSTem:ERRor?

Example: `"SYST:ERR?"`

Features: *RST value: –
SCPI: conforming

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI (cf. Appendix B). If the error queue is empty, the error number 0, "no error", is returned. This command is identical with the command `STATus:QUEue:NEXT?`. This command is a query which is why it is not assigned an *RST value.

SYSTem:PASSword[:CENable]

This command enables access to the service functions by means of the password.

Syntax: SYSTem:PASSword[:CENable] <string>

Example: `"SYST:PASS 'XXXX'"`

Features: *RST value: –
SCPI: conforming

This command has no query

SYSTem:PRESet

This command triggers an instrument reset.

Syntax: SYSTem:PRESet

Example: `"SYST:PRES"`

Features: *RST value: –
SCPI: conforming

The effect of this command corresponds to that of the *PRESET* key with manual control or to the *RST command.

SYSTem:SPEaker:VOLume

This command sets the volume of the built-in loudspeaker for demodulated signals.

Syntax: SYSTem:SPEaker:VOLume <numeric_value>
<numeric_value> ::= 0 to 1

Example: "SYST:SPE:VOL 0.5"

Features: *RST value: 0
SCPI: device-specific

The value 0 is the lowest volume, the value 1 is the highest volume.

SYSTem:TIME

This command sets the internal clock.

Syntax: SYSTem:TIME 0 to 23, 0 to 59, 0 to 59

Example: `"SYST:TIME 12,30,30"`

Features: *RST value: –
SCPI: conforming

The sequence of entry is hour, minute, second.

SYSTem:VERSion?

This command queries the number of the SCPI version, which is relevant for the instrument.

Syntax: SYSTem:VERSion?

Example: `"SYST:VERS?"`

Features: *RST value: –
SCPI: conforming

This command is a query which is why it is not assigned an *RST value.

3.6.19 TRACe Subsystem

The TRACe subsystem controls access to the instrument's internal trace memory.

COMMAND	PARAMETER	UNIT	COMMENT
TRACe [:DATA]	TRACE1 | TRACE2 | TRACE3 | TRACE4, <block>|<numeric_value>...	-	

TRACe[:DATA]

This command transfers trace data from the controller to the instrument, the query reads trace data out of the instrument.

Syntax: TRACe[:DATA] TRACE1 | TRACE2 | TRACE3 | TRACE4,
<block>|<numeric_value>
TRACe[:DATA]? TRACE1 | TRACE2 | TRACE3 | TRACE4'

Example:
```
"TRAC TRACE1,"+A$    (A$: data list in the current format)
"TRAC? TRACE1"
```

Features: *RST value: -
SCPI: conforming

The trace data are transferred in the current format (corresponding to the command FORMat ASCii|REAL). The device-internal trace memory is addressed using the trace names 'TRACE1' to 'TRACE4'.
The parameter of the query is the trace name TRACE1 to TRACE4, it indicates which trace memory will be read out.
The transfer of trace data from the controller to the instrument takes place by indicating the trace name and then the data to be transferred. In ASCII format, these data are values separated by commas. If the transfer takes place using the format real (REAL 32), the data are transferred in block format.

Saving and recalling trace data to/from the device-internal hard disk or to/from a floppy is controlled via the commands "MMEMory:STORe:TRACe" and "MMEMory:LOAD:TRACe" respectively.

3.6.20 TRIGger Subsystem

The TRIGger subsystem is used to synchronize instrument actions with events. This makes it possible to control and synchronize the start of a sweep.

COMMAND	PARAMETER	UNIT	COMMENT
TRIGger			
[SEQuence]			
:SOURce	IMMediate | LINE | EXTerna l |VIDeo | RFPower | TV	–	TV only with option FSE-B3
:LEVel			
[:EXTernal]	<numeric_value>	V|MV|UV	
:VIDeo	<numeric_value>	PCT	
:HOLDoff	<numeric_value>	S	
:SLOPe	POSitive|NEGative	–	
:VIDeo			
:FORMat			
:LPFRame	525 | 625		Option FSE-B3
:FIELd			
:SELect	ALL | ODD | EVEN		Option FSE-B3
:LINE			
:NUMBer	<numeric_value>		Option FSE-B3
:SSIGnal			
:POLarity	NEGative | POSitive		Option FSE-B3

TRIGger[:SEQuence]:SOURce

This command selects the trigger source for the start of a sweep.

Syntax: TRIGger[:SEQuence]:SOURce IMMediate | LINE | EXTernal | VIDeo | RFPower

Example: `"TRIG:SOUR EXT"`

Features: *RST value: IMMediate
SCPI: conforming

The value IMMediate corresponds to the "FREE RUN" setting.

TRIGger[:SEQuence]:LEVel[EXTernal]

This command sets the level of the external trigger source.

Syntax: TRIGger[:SEQuence]:LEVel[EXTernal] <numeric_value>
<numeric_value>::= –5.0 to +5.0V

Example: `"TRIG:LEV 2V"`

Features: *RST value: –5.0V
SCPI: conforming

TRIGger[:SEQuence]:LEVel:VIDeo

This command sets the level of the video trigger source.

Syntax: TRIGger[:SEQuence]:LEVel:VIDeo <numeric_value>
<numeric_value>::= 0 to 100PCT

Example: `"TRIG:LEV:VID 50PCT"`

Features: *RST value: 50 PCT
SCPI: device-specific

TRIGger[:SEQuence]:HOLDoff

This command defines the length of the trigger delay.

Syntax: TRIGger[:SEQuence]:HOLDoff <numeric_value>
<numeric_value>::= 0 to 100s

Example: `"TRIG:HOLD 500us"`

Features: *RST value: 0s
SCPI: conforming

TRIGger[:SEQuence]:SLOPe

This command selects the slope of the trigger signal.

Syntax: TRIGger[:SEQuence]:SLOPe POSitive | NEGative

Example: `"TRIG:SLOP NEG"`

Features: *RST value: POSitive
SCPI: conforming

The selected trigger slope applies to all trigger signal sources.

TRIGger[:SEQuence]:VIDeo:FORMat:LPFRame

This command defines the number of lines per frame to be used (525 or 625 lines)

Syntax: TRIGger[:SEQuence]:VIDeo:FORMat:LPFRame 525 | 625

Example: `"TRIG:VID:FORM:LPFR 525"`

Features: *RST value:
SCPI: conforming

This command is only valid if option FSE-B3 is fitted.

TRIGger[:SEQuence]:VIDeo:LINE:NUMBer

This command selects the horizontal synchronizing signal for triggering.

Syntax: TRIGger[:SEQuence]:VIDeo:LINE:NUMBer

Example: `"TRIG:VID:LINE:NUMB 17"`

Features: *RST value:
SCPI: conforming

The instrument is triggered at the specified line. This command is only valid if option FSE-B3 is fitted.

TRIGger[:SEQuence]:VIDeo:FIELd:SELect

This command selects the vertical synchronizing signal for triggering.

Syntax: TRIGger[:SEQuence]:VIDeo:FIELd:SELect ALL | ODD | EVEN

Example: `"TRIG:VID:FIEL:SEL ALL"`

Features: *RST value:
SCPI: conforming

With the parameter ALL, the instrument is triggered when the field is changed, irrespective of the half fields. With ODD, triggering by the first half field, with even, triggering by the second half field is selected. This command is valid only if option FSE-B3 is fitted.

TRIGger[:SEQuence]:VIDeo:SSIGnal:POLarity

This command defines the polarity of the video synchronizing signal.

Syntax: TRIGger[:SEQuence]:VIDeo:SSIGnal:POLarity NEGative | POSitive

Example: `"TRIG:VID:SSIG:POL NEG "`

Features: *RST value:
SCPI: conforming

This command is valid only if option FSE-B3 is fitted.

3.6.21 UNIT Subsystem

The UNIT subsystem is used to switch the basic unit of setting parameters.

COMMAND	PARAMETER	UNIT	COMMENT
UNIT			
:POWer	DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere		
:PROBe	<Boolean>		

&}

UNIT:POWer

This command selects the default unit for input and output.

Syntax: UNIT:POWer DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere

Example: `"UNIT:POW DBUV"`

Features: *RST value: DBM
SCPI: conforming

UNIT:PROBe

This command determines whether the coding of a probe which is connected to the front panel is taken into consideration (ON) or not (OFF).

Syntax: UNIT:PROBe ON | OFF

Example: `"UNIT:PROB OFF"`

Features: *RST value: ON
SCPI: device-specific

5 Checking Rated Specifications

5.1 Preliminary Remarks:

- Switch off FSE before removing or inserting modules.
- Prior to instrument power-up check the setting of the AC supply voltage selector (230 V).
- Section 5.3.1 describes the final adjustment of FSE, section 5.3.2 (digital modulation) checking of FSE data-sheet specifications. For applicable test values and tolerances see interface data.
- Measure the parameters after a warm-up period of at least 30 min. and internal calibration of FSE.
- Unless specified otherwise all settings are made after a PRESET.
- Conventions for setting the FSE during measurements:

  [***<KEY>***] Press a key on the front panel, eg [SPAN]

  [<SOFTKEY>] Press a softkey, eg [MARKER -> PEAK]

  [<nn unit>] Enter a value and terminate by entering the unit, eg [12 kHz]

  Successive entries are separated by [:], eg [***SPAN***: 15 kHz]

5.2 Test Equipment Required

Item	Instrument type	Required characteristics	Suitable R&S instrument	Order No.	Uses
1	Signal generator with I/Q modulation 9 kHz to 1.9 GHz,	Phase noise at 498 MHz: < -123 dBc/Hz at 10 kHz < -123 dBc/Hz at 100 kHz < -140 dBc/Hz at 1 MHz EVM < 0.5 % after calibration	SMHU 58	835.8011.58	
2	Power meter	100 kHz to 26.5 GHz, error < 0.1 dB	NRVD with sensors NRV-Z7 (FSEA/B) NRV-Z6 (FSEM)	0857.8008.02 0828.5210.22 0828.5010.02	
3	Power splitter	10 MHz to 3.5 GHz (FSEA), 10 MHz to 7 GHz (FSEB), 10 MHz to 26.5 GHz (FSEM)		---	
4	RF step attenuator		RSP	0831.3515.02	
5	Arbitrary waveform generator	Sampling rate ≥ 40 MHz, can be calibrated	ADS (64-k memory) + ADS-B1	1012.4002.02 1013.5748.92	
6	Control software for ADS		IQSIM V4.0 or higher		
7	Test files		FSE-B7 test data	1066.4452.00	
8	FSE service kit		FSE-Z1	1066.3862.02	

5.3 Test Procedure

5.3.1 Final Adjustment

5.3.1.1 Adjustment of 10-MHz Filter in the Spectrum Analyzer Mode

- Operate 2nd IF CONVERTER module outside the unit using the FSE service kit.
- Remove RF cover at component side and place a test cover onto the VCO case.
- Connect RF input to calibration source (SETUP→SERVICE→INPUT CAL).
- Check filter curve with the settings below:
  Mode: Analyzer
  Center: 120 MHz
  Span: 20 MHz
  RBW: 10 MHz
  VBW: 100 kHz
  Range: Log 10 dB
  Ref. Level: - 38 dBm
- Measure level at 120 MHz and note down measurement result.
- Adjust filter curve using C21, C138, C140, C229, C141, C143 and C 144 so that the following conditions are met:
  Characteristic symmetrical to center frequency and flat at center frequency. Minimum requirement: < 1 dB attenuation at ± 2 MHz compared to minimum attenuation.
  3-dB bandwidth:..... 9 MHz to 12.5 MHz.
  Level at center frequency: ..... previous value ±0.5 dB.
- Screw on RF cover and fit module in the unit.
- After the adjustment trigger a total calibration.

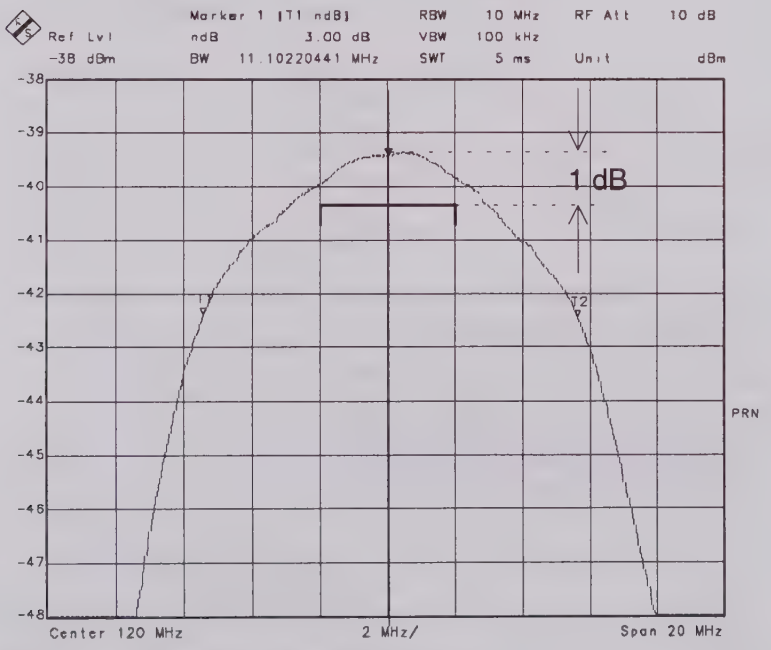


Fig. 5-1 Example of a filter adjustment

5.3.1.2 Adjustment and Check of Level Display in the Vector Analyzer Mode (Mag Cap Buffer)

Test setup: Apply 120-MHz signal from signal generator to FSE input, level -10 dBm

Settings on FSE:

Mode: Vector analyzer

Digital standard	GSM
MEAS RESULT	MAG CAP BUFFER
CENTER	120 MHz
RBW	10 MHz
REF LVL	-7 dBm
RANGE:REF VALUE	-7 dBm
Input	Low Dist

Adjustment:

- *[**MARKER SEARCH**: Modulation Marker: RMS]*
- Read RMS marker level and check for:..... 40 dBm ±0.5 dB,
- Select INPUT:LOW NOISE.
- Adjust marker level with R144 on I/O board to the same level as measured with LOW DIST ..... ±0.03 dB.
- Switch on INPUT: ATTEN AUTO NORMAL.
- Adjust marker level with R 362 on the I/O board to the same level as measured with LOW DIST ..... ±0.03 dB.
- Trigger I/Q calibration

5.3.2 Digital Demodulation

5.3.2.1 Absolute Accuracy at 120 MHz

Test setup: Connect signal generator to RF input of FSE via a power splitter.
Level -4 dBm
Frequency 120 MHz

Settings on FSE:
[REF LVL:-7 dBm]
[CENTER FREQUENCY:20 MHz]
[MODE: VECTOR ANALYZER: DIGITAL STANDARD:GSM]
[MEAS RESULT: MAG CAP BUFFER]
[REF VALUE: -7 dBm]
[Memory Size: 8000 points: FraME LEngth: 400 Symbols]
[RESULT LENGTH 400 SYMBOLS: Find Burst oFF]
[SUMMARY MKR ON, AVG/HOLD ON, SWEEP COUNT: 10, SINGLE SWEEP]

Measurement:
- Comparison measurement with NRVD power sensor:
  - *[CENTER: f_{Freq}]*
    [MODULATION MARKER: RMS]
    Read marker level.
  - Nominal value ..... level at power meter
    The difference between the level displays of power meter and FSE is the absolute error (at 120 MHz only). It is used as reference error.
    Nominal value (absolute) : .....< ±0.4 dB deviation*)

5.3.2.2 Display Linearity

Test equipment:
Signal generator
RF Step Attenuator RSG, DC correction

Test setup: Connect signal generator via the attenuator to the RF input of FSE.
Frequency 120 MHz
Level -4 dBm
Level at FSE input approx. -10 dBm

Measurement:
- Reference = 0 dB below REF LVL. (ref. = reference attenuation)
  - Increase attenuation of step attenuator ATT_{RSG} by 50 dB in 5-dB steps.
  - Read level on FSE *[MODULATION MARKER:RMS]* for each step.
    Nominal level ..... -10 dBm - (ATT_{RSG} - ref.)
    Permissible deviation up to 10 dB attenuation: ..... 0.2 dB
    Permissible deviation up to 30 dB: ..... 0.85 dB
    Permissible deviation up to 50 dB: ..... 1.5 dB

*) Compared to FSE calibration, the absolute error may be 0.1 dB higher so that a total error of 1 dB is still obtained. This applies because the linearity error of FSE-B7, which corresponds to the log error (0.3 dB), is only max. 0.2 dB.

5.3.2.3 Checking the Dynamic Range for Burst Measurements

Test equipment: Signal generator (SMHU58), modulated with ADS

Test setup: Connect signal generator to RF input of FSE (level -10 dBm)

Settings on FSE:

- *[REF LVL:-10 dBm]*
  [MODE: VECTOR ANALYZER]
- Set required modulation standard according to table:
  - *[MEAS RESULT: MAG CAP BUFFER]*
  - *[REF VALUE:-10 dBm]*
  - *[Memory Size: 8000 points, FraME LEngth: 400 Symbols]*
  - *[RESULT LENGTH: 400 SYMBOLS, 4 points per Symbol, Find Burst oN],*
  - *[INPUT:ATTEN: LOW NOISE]*
- Increase level of signal generator (individually for each standard) in 1-dB steps until IFOVLD is displayed, then reduce by 1 dB.
- Determine dynamic range MAG CAP BUFFER according to table:
  - Set marker 1 to maximum with PEAK SEARCH.
  - Note down displayed value.
  - Set signal generator level to minimum (-139 dBm) and deduct displayed value of FSE summary marker MEAN. The difference between the displayed values is the available dynamic range.
  - *[SUMMARY MKR ON, SUMMARY MKR⇓: MEAN, AVG/HOLD ON, SWEEP COUNT: 10, SINGLE SWEEP]*

	Dynamic range of MAG CAP BUFFER
GMSK (GSM standard) **Symbol rate: 270.833 kHz,** **MEAS FILTER: NONE** **REF FILTER: GAUSS** **B*T: 0.3** **f_{RF} = 960 MHz** **RESULT LENGTH:** **400 symbols**	> 67.3 dB Typ. 70.3 dB
π/4-DQPSK **(TETRA standard)** **Symbol rate: 18 kHz,** **MEAS FILTER: ROOT COS** **REF FILTER: COS** **B*T: 0.35** **f_{RF} = 900 MHz**	> 72 dB typ. 75 dB

5.3.2.4 Checking the Residual Error (no FSK signals)

Test equipment: 4-GHz signal generator (SMHU58, externally synchronized with DCF77), modulated with ADS (also externally synchronized) via IQSIM software.

Note: *Prior to measuring the residual error, calibrate the I/Q modulator on SMHU 58 (Shift Special 320) and adjust the offset on the ADS (Special function/DIAG/CAL 0).*

Calibration of signal generator:

- ➢ Adjust the carrier suppression to > 65 dB on both channels by varying the CAL D/A converters (output frequency 100 kHz, 1 V on the two ADS channels, phase 90°).
- ➢ Remove the imbalance on the I and Q channels using special function 301 and I>Q and also the QUAD offset by adjusting the 2nd sideband (carrier + 100 kHz) to > 65 dB.
- ➢ After setting a DIGITAL STANDARD on the ADS, program again the setting values of the two CAL D/A converters.

Test setup: Connect signal generator to RF input of FSE (frequency 500 MHz with -20 dBm)
Synchronize FSE externally with DCF 77.

Settings on FSE: Set required modulation standard according to table and also *[MEAS RESULT: SYMB TABLE/ERRORS], [TRACE: AVERAGE, SWEEP COUNT: 10, SINGLE SWEEP]*

Measurement:

- ➢ Generate the standard test signals (see table below) on the ADS with I/Q SIM and check the residual error as required by the model. To do so set the frequency of signal generator and FSE to the f_{RF} indicated in the table.

FSEA30 + B7 (or FSEA20 + B4 + B7):

	ADS test signal
GMSK **Symbol rate: 270.833 kHz,** **f_{RF} = 960 MHz,** ***[DIGITAL STANDARD: GSM],*** ***[TRIGGER:FIND SYNC ON]***	GSMSTAN.IQS
GMSK **Symbol rate: 270.833 kHz,** **f_{RF} = 1900 MHz** ***[DIGITAL STANDARD:PCS1900]***	GSMSTAN.IQS
π/4-DQPSK **Symbol rate: 24.3 kHz** **f_{RF} = 894 MHz,** ***[DIGITAL STANDARD: NADC,*** ***TRIGGER:FIND SYNC ON]***	NADC_S1.IQS
π/4-DQPSK, **f_{RF} = 900 MHz** **Symbol rate 18 kHz** ***[DIGITAL STANDARD:TETRA]***	TETRA2.IQS
π/4-DQPSK **Symbol rate: 21 kHz** **f_{RF} = 900 MHz** ***[DIGITAL STANDARD:PDC]-***	PDC1.IQS
π/4-DQPSK **Symbol rate: 192 kHz,** **f_{RF} = 1900 MHz** ***DIGITAL STANDARD: PHS***	PHS1.IQS
π/4-DQPSK **Symbol rate: 576 kHz,** **f_{RF} = 1900 MHz** ***[DIGITAL STANDARD: WCPE]***	WCPE1.IQS
QPSK **Symbol rate 1.2288 MHz** ***[DIGITAL STANDARD: QCDMA FORWARD CH]***	QCDMA_F1.IQS
OQPSK **Symbol rate 1.2288 MHz** ***[DIGITAL STANDARD: QCDMA REVERSE CH]***	QCDMA_R1.IQS

5.3.2.5 Checking the Residual Error (FSK signals)

Test equipment: Signal generator (SMHU58, externally synchronized with DCF77), modulated with ADS (also externally synchronized) via IQSIM software. Calibrate as described in section 5.3.2.4.

Test setup: Connect signal generator to RF input of RSE.
(frequency 500 MHz with -10 dBm)
Synchronize FSE externally with DCF 77.

Settings on FSE: Set required modulation standard according to table and also *[RESULT DISPLAY: SYMB TABLE/ERRORS, TRACE: AVERAGE, SWEEP ..... SINGLE SWEEP, INPUT:ATTEN MANUAL:LOW NOISE, REF LEVEL:-10DBM]*

Measurement: Generate the standard test signals (see table below) on the ADS with I/Q SIM and check residual error as required by the model.

	ADS test signal
4-FSK Symbol rate: 3.125 kHz, f_{RF} = 169.8 MHz *[DIGITAL STANDARD:ERMES]*	ERMES1.IQS
2-FSK **Symbol rate 72 kHz** f_{RF} = 900 MHz *[DIGITAL STANDARD: CT2_1]*	CT2_1.IQS
2-FSK Symbol rate: 1.152 MHz, f_{RF} = 1900 MHz *[DIGITAL STANDARD:DECT]*	DECT1.IQs

5.4 Performance Test Report

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
1	Absolute accuracy of level display	5.4.1.1.1	-0.4		+0.4	dB
2	Linearity of level display	5.4.1.1.1				
	a = 10 dB		-0.2		+0.2	dB
	a=30 dB		-0.85		+0.85	dB
	a=50 dB		-1.5		+1.5	dB
3	Useful dynamic range GSM:		67.3			dB
	NADC:		72			dB
Residual error - no FSK FSEA30 or FSEA20 incl. FSE-B4:						
4	**PCS1900**					
	EVM rms:		---	.....	1	%
	Magnitude error rms:		---	.....	1	%
	Phase error rms:		---	.....	0.5	°
	Phase error pk:		---	.....	2.1	°
	I/Q offset:		---	.....	0.2	%
	Freq. error:		-1.45	.....	1.45	Hz
5	**NADC (PDC, TETRA)**					
	EVM rms:		---	.....	0.5	%
	EVM pk:		---	.....	2.1	%
	Magnitude error rms:		---	.....	0.5	%
	I/Q offset:		---	.....	0.2	%
	Freq. error:		-0.22	.....	+ 0.22	Hz

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
6	**PHS**					
	EVM rms:		---	.....	1	%
	EVM pk:		---	.....	4.5	%
	Magnitude error rms:		---	.....	1	%
	I/Q offset:		---	.....	0.2	%
	Freq. error:		-1.06	.....	+ 1.06	Hz
7	**QCDMA FORWARD CH:**					
	EVM rms:		---	.....	2	%
	EVM pk:		---	.....	9	%
	Magnitude error rms:		---	.....	2	%
	I/Q offset:		---	.....	0.2	%
	Freq. error:		-6.2	.....	+ 6.2	Hz
	RHO factor		0.9995	.....	---	---
8	**QCDMA REVERSE CH:**					
	EVM rms:		---	.....	2	%
	EVM pk:		---	.....	9	%
	Magnitude error rms:		---	.....	2	%
	I/Q offset:		---	.....	0.2	%
	Freq. error:		-6.2	.....	+ 6.2	Hz
	RHO factor		0.9995	.....	---	---

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
Residual error - no FSK FSEA20 (without FSE-B4):						
9	**PCS1900**					
	EVM rms		---		3	%
	Magnitude error rms		---	.....	3	%
	Phase error rms		---	.....	1.5	°
	Phase error pk		---	.....	6.3	°
	I/Q offset		---	.....	0.6	%
	Freq. error		-4.35	.....	4.35	Hz
				.....		
10	**NADC (PDC, TETRA)**					
	EVM rms:		---	.....	1.5	%
	EVM pk:		---	.....	6.3	%
	Magnitude error rms:		---	.....	1.5	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-0.66	.....	+ 0.66	Hz
11	**PHS**					
	EVM rms:		---	.....	3	%
	EVM pk:		---	.....	12.5	%
	Magnitude error rms:		---	.....	3	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-3.18	.....	+ 3.18	Hz
12	**QCDMA FORWARD CH:**					
	EVM rms:		---	.....	6	%
	EVM pk:		---	.....	25	%
	Magnitude error rms:		---	.....	2	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-18.5	.....	+ 18.5	Hz
	RHO factor		0.9985	.....	---	---

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
13	**QCDMA REVERSE CH:**					
	EVM rms:		---	.....	6	%
	EVM pk:		---	.....	25	%
	Magnitude error rms:		---	.....	6	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-18.5	.....	+ 18.5	Hz
	RHO factor		0.9985	.....	---	---
Residual error - no FSK FSEB30, FSEM30 or FSEB20, FSEM20 incl. FSE-B4:						
14	**PCS1900**					
	EVM rms:		---		1.4	%
	Magnitude error rms:		---	.....	1.4	%
	Phase error rms:		---	.....	0.7	°
	Phase error pk:		---	.....	3	°
	I/Q offset:		---	.....	0.28	%
	Freq. error:		-2	.....	2	Hz
				.....		
15	**NADC (PDC, TETRA)**					
	EVM rms:		---	.....	0.7	%
	EVM pk:		---	.....	3	%
	Magnitude error rms:		---	.....	0.7	%
	I/Q offset:		---	.....	0.28	%
	Freq. error:		-0.3	.....	+ 0.3	Hz

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
16	**PHS**					
	EVM rms:		---	.....	1.4	%
	EVM pk:		---	.....	6.3	%
	Magnitude error rms:		---	.....	1.4	%
	I/Q offset:		---	.....	0.28	%
	Freq. error:		-1.4	.....	+ 1.4	Hz
17	**QCDMA FORWARD CH:**					
	EVM rms:		---	.....	2.8	%
	EVM pk:		---	.....	12.7	%
	Magnitude error rms:		---	.....	2.8	%
	I/Q offset:		---	.....	0.28	%
	Freq. error:		-8.7	.....	+ 8.7	Hz
	RHO factor		0.9993	.....	---	---
18	**QCDMA REVERSE CH:**					
	EVM rms:		---	.....	2.8	%
	EVM pk:		---	.....	12.7	%
	Magnitude error rms:		---	.....	2.8	%
	I/Q offset:		---	.....	0.28	%
	Freq. error:		-8.7	.....	+ 8.7	Hz
	RHO factor		0.9993	.....	---	---
Residual error - no FSK FSEB20, FSEM20 without FSE-B4:						
19	**PCS1900** EVM rms:		---	.....	4.2	%
	Magnitude error rms:		---	.....	4.2	%
	Phase error rms:		---	.....	2.1	°
	Phase error pk:		---	.....	8.9	°
	I/Q offset:		---	.....	0.84	%
	Freq. error:		-6.1	.....	6.1	Hz

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
20	**NADC (PDC, TETRA)**					
	EVM rms:		---	.....	2.1	%
	EVM pk:		---	.....	8.9	%
	Magnitude error rms:		---	.....	2.1	%
	I/Q offset:		---	.....	0.84	%
	Freq. error:		-0.9	.....	+ 0.9	Hz
21	**PHS**					
	EVM rms:		---	.....	4.2	%
	EVM pk:		---	.....	17.8	%
	Magnitude error rms:		---	.....	4.2	%
	I/Q offset:		---	.....	0.84	%
	Freq. error:		-4.4	.....	+ 4.4	Hz
22	**QCDMA FORWARD CH:**					
	EVM rms:		---	.....	8.4	%
	EVM pk:		---	.....	25.2	%
	Magnitude error rms:		---	.....	8.4	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-18.5	.....	+ 18.5	Hz
	RHO factor		0.9985	.....	---	---
23	**QCDMA REVERSE CH:**					
	EVM rms:		---	.....	8.4	%
	EVM pk:		---	.....	25.2	%
	Magnitude error rms:		---	.....	8.4	%
	I/Q offset:		---	.....	0.6	%
	Freq. error:		-18.5	.....	+ 18.5	Hz
	RHO factor		0.9985	.....	---	---

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
Residual error - FSK FSEA30, FSEA20 + FSE-B4:						
24	**ERMES:**					
	Magnitude error rms:		---	---	1	%
	FSK dev. error rms		---	.....	46.8	Hz
	FSK dev. of nom.		-46.8	.....	+46.8	Hz
	Freq. error		-23.4	.....	23.4	Hz
25	**CT2:**					
	Magnitude error rms:		---	---	1	%
	FSK dev. error rms		---	.....	180	Hz
	FSK dev. of nom.		-180	.....	+180	Hz
	Freq. error		-90	.....	+90	Hz
26	**DECT:**					
	Magnitude error rms:		---	----	2	%
	FSK dev. error rms		---	.....	5.76	kHz
	FSK dev. of nom.		-5.76	.....	+5.76	kHz
	Freq. error		-2.88	.....	+2.88	kHz
Residual error - FSK FSEA20 without FSE-B4:						
27	**ERMES:**					
	Magnitude error rms:		---	----	3	%
	FSK dev. error rms		---	.....	140	Hz
	FSK dev. of nom.		-140	.....	+140	Hz
	Freq. error		-70	.....	70	Hz
28	**CT2:**					
	Magnitude error rms:		---	----	1	%
	FSK dev. error rms		---	.....	540	Hz
	FSK dev. of nom.		-540	.....	+540	Hz
	Freq. error		-270	.....	+270	Hz

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
29	**DECT:**					
	Magnitude error rms:		---	----	2	%
	FSK dev. error rms		---	.....	5.76	kHz
	FSK dev. of nom.		-5.76	.....	+5.76	kHz
	Freq. error		-2.88	.....	+2.88	kHz
30	**Residual error - FSK** **FSEB30, FSEM30 or FSEB20, FSEM20 + FSE-B4:**					
31	**ERMES:**					
	Magnitude error rms:		----	----	1	%
	FSK dev. error rms		----	.....	46.8	Hz
	FSK dev. of nom.		-46.8	.....	+46.8	Hz
	Freq. error		-23.4	.....	23.4	Hz
32	**CT2:**					
	Magnitude error rms:		----	----	1	%
	FSK dev. error rms		----	.....	180	Hz
	FSK dev. of nom.		-180	.....	+180	Hz
	Freq. error		-90	.....	+90	Hz
33	**DECT:**					
	Magnitude error rms:		----	----	2	%
	FSK dev. error rms		----	.....	5.76	kHz
	FSK dev. of nom.		-5.76	.....	+5.76	kHz
	Freq. error		-2.88	.....	+2.88	kHz

Item	Characteristic	Measure acc. to section	Min. value	Act. value	Max. value	Unit
Residual error - FSK FSEB20, FSEM20 without FSE-B4:						
34	**ERMES:**					
	Magnitude error rms:		----	----	1	%
	FSK dev. error rms		----	.....	46.8	Hz
	FSK dev. of nom.		-46.8	.....	+46.8	Hz
	Freq. error		-23.4	.....	23.4	Hz
35	**CT2:**					
	Magnitude error rms:		---	----	1	%
	FSK dev. error rms		---	.....	180	Hz
	FSK dev. of nom.		-180	.....	+180	Hz
	Freq. error		-90	.....	+90	Hz
36	**DECT:**					
	Magnitude error rms:		----		2	%
	FSK dev. error rms		----	.....	5.76	kHz
	FSK dev. of nom.		-5.76	.....	+5.76	kHz
	Freq. error		-2.88	.....	+2.88	kHz

Annex C – List of Commands

Command	Parameter	Page
ABORt		3.6-7
CALCulate<1|2>:DELTamarker<1 to 4> AOFF		3.6-9
CALCulate<1|2> DELTamarker<1 to 4> FUNCtion FIXed:RPOint:X	<numeric value>	3.6-12
CALCulate<1|2> DELTamarker<1 to 4> FUNCtion FIXed RPOint:Y	<numeric value>	3.6-11
CALCulate<1|2> DELTamarker<1 to 4> FUNCtion FIXed RPOint Y OFFSet	<numeric value>	3.6-12
CALCulate<1|2> DELTamarker<1 to 4> FUNCtion FIXed[:STATe]	ON | OFF	3.6-11
CALCulate<1|2>:DELTamarker<1 to 4> FUNCtion PNOise:RESult?		3.6-12
CALCulate<1|2>:DELTamarker<1 to 4>:FUNCtion:PNOise[:STATe]	ON | OFF	3.6-12
CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:LEFT		3.6-10
CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:NEXT		3.6-10
CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum:RIGHt		3.6-10
CALCulate<1|2>:DELTamarker<1 to 4>:MAXimum[:PEAK]		3.6-10
CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:LEFT		3.6-11
CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:NEXT		3.6-11
CALCulate<1|2>:DELTamarker<1 to 4>:MINimum:RIGHt		3.6-11
CALCulate<1|2>:DELTamarker<1 to 4>:MINimum[:PEAK]		3.6-10
CALCulate<1|2>:DELTamarker<1 to 4>:MODE	ABSolute | RELativ	3.6-9
CALCulate<1|2>:DELTamarker<1 to 4>:STEP:AUTO	ON | OFF	3.6-13
CALCulate<1|2>:DELTamarker<1 to 4>:STEP[:INCRement]	<numeric value>	3.6-13
CALCulate<1|2>:DELTamarker<1 to 4>:TRACe	1 to 4	3.6-9
CALCulate<1|2>:DELTamarker<1 to 4>:X	0 to MAX (frequency) | MAX (sweep time)	3.6-9
CALCulate<1|2>:DELTamarker<1 to 4>:Y?		3.6-9
CALCulate<1|2>:DELTamarker<1 to 4>[:STATe]	ON | OFF	3.6-8
CALCulate<1|2>:DLINe<1|2>	MINimum to MAXimum (depending on current unit)	3.6-14
CALCulate<1|2>:DLINe<1|2>:STATe	ON | OFF	3.6-14
CALCulate<1|2>:FEED	'XTIM:DDEM:MEAS' | 'XTIM:DDEM:REF' | 'XTIM:DDEM:ERR:MPH' | 'XTIM:DDEM:ERR:VECT' | 'XTIM:DDEM:SYMB' | 'TCAP'	3.6-17
CALCulate<1|2>:FLINe<1|2>	0 GHz to f_{max}	3.6-15

Command	Parameter	Page
CALCulate<1|2>:FLINe<1|2>:STATe	ON | OFF	3.6-15
CALCulate<1|2>:FORMat	MAGNitude | PHASe | UPHase | RIMag | FREQuency | IEYE | QEYE | TEYE | FEYE | COMP | CONS	3.6-18
CALCulate<1|2>:FSK:DEViation:REFerence	<numeric value>	3.6-18
CALCulate<1|2>:LIMit<1 to 8>:CLEar[:IMMediate]		3.6-23
CALCulate<1|2>:LIMit<1 to 8>:CONTrol:DOMain	FREQuency | TIME	3.6-20
CALCulate<1|2>:LIMit<1 to 8>:CONTrol:OFFset	<numeric value>	3.6-20
CALCulate<1|2>:LIMit<1 to 8>:CONTrol[:DATA]	<numeric value>,<numeric value>..	3.6-20
CALCulate<1|2>:LIMit<1 to 8>:FAIL?		3.6-23
CALCulate<1|2>:LIMit<1 to 8>:LOWer:MARGin	<numeric value>	3.6-22
CALCulate<1|2>:LIMit<1 to 8>:LOWer:MODE	RELative | ABSolute	3.6-22
CALCulate<1|2>:LIMit<1 to 8>:LOWer:OFFset	<numeric value>	3.6-22
CALCulate<1|2>:LIMit<1 to 8>:LOWer:STATe	ON | OFF	3.6-22
CALCulate<1|2>:LIMit<1 to 8>:LOWer[:DATA]	<numeric value>	3.6-22
CALCulate<1|2>:LIMit<1 to 8>:STATe	ON | OFF	3.6-19
CALCulate<1|2>:LIMit<1 to 8>:UNIT	DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere	3.6-19
CALCulate<1|2>:LIMit<1 to 8>:UPPer:MARGin	<numeric value>	3.6-21
CALCulate<1|2>:LIMit<1 to 8>:UPPer:MODE	RELative | ABSolute	3.6-21
CALCulate<1|2>:LIMit<1 to 8>:UPPer:OFFset	<numeric value>	3.6-21
CALCulate<1|2>:LIMit<1 to 8>:UPPer:STATe	ON | OFF	3.6-21
CALCulate<1|2>:LIMit<1 to 8>:UPPer[:DATA]	<numeric value>,<numeric value>..	3.6-21
CALCulate<1|2>:MARKer<1 to 4>:AOFF		3.6-26
CALCulate<1|2>:MARKer<1 to 4>:COUNt	ON | OFF	3.6-26
CALCulate<1|2>:MARKer<1 to 4>:COUNt:FREQuency?		3.6-27
CALCulate<1|2>:MARKer<1 to 4>:COUNt:RESolution	0.1 | 1 | 10 | 100 | 1000 | 10000 Hz	3.6-27
CALCulate<1|2>:MARKer<1 to 4>:COUPled[STATe]	ON | OFF	3.6-27
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DDEMod:RESult?	MERM | PERM | EVRM | IQOF |ADR | FERR | RHO	3.6-33
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:HOLDoff	10ms to 1000s	3.6-32
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation:SELect	AM | FM	3.6-31
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:DEModulation[:STATe]	ON | OFF	3.6-31
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown	<numeric value>	3.6-30
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:FREQuency?		3.6-30

Command	Parameter	Page
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:RESult?		3.6-30
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NDBDown:STATe	ON | OFF	3.6-30
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe:RESult?		3.6-31
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:NOISe[:STATe]	ON | OFF	3.6-31
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:CFILter	ON | OFF	3.6-34
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:PRESet	NADC | TETRA | PDC | PHS | CDPD | NONE	3.6-34
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer:RESult?	ACPower | CPOWer | OBANdwidth | OBWidth | CN | CN0	3.6-34
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:POWer[:STATe]	OFF	3.6-34
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor	(60dB/3dB) | (60dB/6dB)	3.6-32
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:FREQuency?		3.6-33
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:RESult?		3.6-32
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:SFACtor:STATe	ON | OFF	3.6-32
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:STRack[:STATe]	ON | OFF	3.6-33
CALCulate<1|2>:MARKer<1 to 4>:FUNCtion:ZOOM	<numeric value>	3.6-31
CALCulate<1|2>:MARKer<1 to 4>:MAXimum:LEFT		3.6-28
CALCulate<1|2>:MARKer<1 to 4>:MAXimum:NEXT		3.6-28
CALCulate<1|2>:MARKer<1 to 4>:MAXimum:RIGHt		3.6-28
CALCulate<1|2>:MARKer<1 to 4>:MAXimum[:PEAK]		3.6-27
CALCulate<1|2>:MARKer<1 to 4>:MINimum:LEFT		3.6-29
CALCulate<1|2>:MARKer<1 to 4>:MINimum:NEXT		3.6-28
CALCulate<1|2>:MARKer<1 to 4>:MINimum:RIGHt		3.6-29
CALCulate<1|2>:MARKer<1 to 4>:MINimum[:PEAK]		3.6-28
CALCulate<1|2>:MARKer<1 to 4>:PEXCursion	<numeric value>	3.6-29
CALCulate<1|2>:MARKer<1 to 4>:READout	MPHase | RIMaginary	3.6-30
CALCulate<1|2>:MARKer<1 to 4>:STEP:AUTO	ON | OFF	3.6-29
CALCulate<1|2>:MARKer<1 to 4>:STEP[:INCRement]	<numeric value>	3.6-29
CALCulate<1|2>:MARKer<1 to 4>:TRACe	1 to 4	3.6-26
CALCulate<1|2>:MARKer<1 to 4>:X	0 to MAX (frequency)|MAX (sweep time)	3.6-26
CALCulate<1|2>:MARKer<1 to 4>:X:SLIMits[:STATe]	ON | OFF	3.6-26
CALCulate<1|2>:MARKer<1 to 4>:Y?		3.6-27
CALCulate<1|2>:MARKer<1 to 4>[:STATe]	ON | OFF	3.6-25
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AOFF		3.6-38
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:AVERage	ON | OFF	3.6-38

CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MAXimum:RESult?		3.6-35
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MAXimum[:STATe]	ON | OFF	3.6-35
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN:RESult?		3.6-37
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MEAN[:STATe]	ON | OFF	3.6-37
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle:RESult?		3.6-36
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MIDDle[:STATe]	ON | OFF	3.6-36
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak:RESult?	ON | OFF	3.6-36
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:MPEak[:STATe]	ON | OFF	3.6-36
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PHOLd	ON | OFF	3.6-37
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak:RESult?	ON | OFF	3.6-35
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:PPEak[:STATe]	ON | OFF	3.6-35
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS:RESult?	ON | OFF	3.6-37
CALCulate<1|2>:MARKer<1...4>:FUNCtion:SUMMary:RMS[:STATe]	ON | OFF	3.6-37
CALCulate<1|2>:RLINe	MINimum to MAXimum (depending on current unit)	3.6-15
CALCulate<1|2>:RLINe:STATe	ON | OFF	3.6-15
CALCulate<1|2>:THReshold	MINimum to MAXimum (depending on current unit)	3.6-14
CALCulate<1|2>:THReshold:STATe	ON | OFF	3.6-15
CALCulate<1|2>:TLINe<1|2>	0 to 1000s	3.6-16
CALCulate<1|2>:TLINe<1|2>:STATe	ON | OFF	3.6-16
CALCulate<1|2>:UNIT:ANGLe	DEG | RAD	3.6-39
CALCulate<1|2>:UNIT:POWer	DBM | V | W | DB | PCT | UNITLESS | DBPW | WATT | DBUV | VOLT | DBUA | AMPere	3.6-39
CALCulate<1|2>:X:UNIT:TIME	S | SYM	3.6-39
CALCulate[1|2>:LIMit<1 to 8>:CONTrol:MODE	RELative | ABSolute	3.6-20
CALibration:BANDwidth| BWIDth[:RESolution?]		3.6-40
CALibration:IQ?		3.6-40
CALibration:LDETector?		3.6-41
CALibration:LOSuppression?		3.6-41
CALibration:PPEak?		3.6-41

CALibration:SHORt?		3.6-41
CALibration:STATe	ON | OFF	3.6-41
CALibration[:ALL]		3.6-40
DIAGnostic:SERVice:FUNCtion	numeric value>,<numeric value>	3.6-42
DIAGnostic:SERVice:INPut[:SELect]	CALibration | RF	3.6-42
DIAGnostic:SERVice:NSOurce	ON|OFF	3.6-42
DISPlay:FORmat	SINGle | SPLit	3.6-43
DISPlay:PROGram[:MODE]	ON | OFF	3.6-43
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:EYE:COUNt	1 to Result Length	3.6-46
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:MODE	WRITe | VIEW | AVERage | MAXHold | MINHold	3.6-46
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:SYMBol	DOTS | BARS | OFF	3.6-46
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:X[:SCALe]:RVALue	<numeric value>	3.6-44
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y:SPACing	LINear | LOGarithmic | PERCent	3.6-45
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]	10dB to 200dB	3.6-44
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:PDIVision	<numeric value>	3.6-45
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel	-200dBm to 200dBm	3.6-44
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RLEVel:OFFSet	-200dB to 200dB	3.6-44
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RPOSition	0 to 100 PCT	3.6-45
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>:Y[:SCALe]:RVALue	<numeric value>	3.6-45
DISPlay[:WINDow<1|2>]:TRACe<1 to 4>[:STATe]	ON | OFF	3.6-46
FORMat[:DATA]	ASCii | REAL[,UINT [,32]	3.6-47
HCOPy:ABORt		3.6-48
HCOPy:DESTination<1|2>	'SYST:COMM:GPIB' | 'SYST:COMM:SER1' | 'SYST:COMM:SER2' | 'SYST:COMM:CENT' | 'MMEM'	3.6-49
HCOPy:DEVice:COLor	ON | OFF	3.6-49
HCOPy:DEVice:ITEM:ALL		3.6-50
HCOPy:DEVice:ITEM:FFEed<1|2>:STATe	ON | OFF	3.6-50
HCOPy:DEVice:ITEM:LABel:TEXT	<string>	3.6-51
HCOPy:DEVice:ITEM:PFEed<1|2>:STATe	ON | OFF	3.6-51
HCOPy:DEVice:ITEM:WINDow<1|2>:TABle:STATe	ON | OFF	3.6-51
HCOPy:DEVice:ITEM:WINDow<1|2>:TEXT	<string>	3.6-51
HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:CAINcrement	ON | OFF	3.6-52
HCOPy:DEVice:ITEM:WINDow<1|2>:TRACe:STATe	ON | OFF	3.6-51

HCOPy:DEVice:LANGuage<1|2>	HPGL | PCL4 | PCL5 | POSTscript | ESCP | WMF | PCX | HP7470	3.6-49
HCOPy:DEVice:PRESet<1|2>	ON | OFF	3.6-49
HCOPy:DEVice:RESolution<1|2>	150 | 300	3.6-50
HCOPy:PAGE:DIMensions:FULL		3.6-52
HCOPy:PAGE:DIMensions:QUADrant<1 to 4>		3.6-52
HCOPy:PAGE:ORIentation<1|2>	LANDscape | PORTrait	3.6-52
HCOPy[:IMMediate]		3.6-50
INITiate:CONTinuous	ON | OFF	3.6-53
INITiate:DISPlay	ON | OFF	3.6-53
INITiate[:IMMediate]		3.6-53
INPut:ATTenuation	0 to 70dB	3.6-54
INPut:ATTenuation:AUTO	ON | OFF	3.6-54
INPut:ATTenuation:AUTO:MODE	NORMal | LNOise | LDIStorsion	3.6-54
INPut:IMPedance	50 | 75	3.6-55
INPut:IMPedance:CORRection	RAM | RAZ	3.6-55
INPut:MIXer	<numeric value>	3.6-55
INPut:UPORt<1|2>:STATe	ON | OFF	3.6-55
INPut:UPORt<1|2>[:VALue]?		3.6-55
INSTrument:NSELect	1|2	3.6-56
INSTrument[:SELect]	SANalyzer | DDEMod	3.6-56
MMEMory:CDIRectory	directory name	3.6-57
MMEMory:COPY	path, file name	3.6-58
MMEMory:DELete	path, file name	3.6-58
MMEMory:INITialize	'A:'	3.6-58
MMEMory:LOAD:STATe	path, file name	3.6-59
MMEMory:MDIRectory	path	3.6-59
MMEMory:MOVE	path, file name	3.6-59
MMEMory:MSIS	'A:' | 'C:'	3.6-60
MMEMory:NAME	path, file name	3.6-60
MMEMory:RDIRectory	directory name	3.6-60
MMEMory:STORe:STATe	path, file name	3.6-60
OUTPut:UPORt<1|2>:STATe	ON | OFF	3.6-61
OUTPut:UPORt<1|2>[:VALue]	00000000 to 11111111	3.6-61
OUTPut[:STATe]	ON | OFF	3.6-61
[SENSe:]DDEMod:FILTer:ALPHa	0.2 to 1	3.6-70

[SENSe:]DDEMod:FILTer:MEASurement	OFF | RCOSine | RRCosine | GAUSsian	3.6-69
[SENSe:]DDEMod:FILTer:REFerence	RCOSine | RRCosine | GAUSsian	3.6-69
[SENSe:]DDEMod:FORMat	QPSK | PSK | MSK | QAM | FSK	3.6-67
[SENSe:]DDEMod:FSK:NSTate	2 | 4	3.6-68
[SENSe:]DDEMod:MSK:FORMat	TYPE1 | TYPE2 | NORMal | DIFFerential	3.6-68
[SENSe:]DDEMod:NORMalize	ON | OFF	3.6-70
[SENSe:]DDEMod:PRATe	1 | 2 | 4 | 8 | 16	3.6-69
[SENSe:]DDEMod:PRESet	GSM | NADC | TETRa | DCS1800 | PCS1900 | PHS | PDC | CDPD	3.6-71
[SENSe:]DDEMod:PSK:FORMat	2 | 8	3.6-68
[SENSe:]DDEMod:PSK:NSTate	2 | 8	3.6-68
[SENSe:]DDEMod:QPSK:FORMat	NORMal | DIFFerential | OFFSet	3.6-68
[SENSe:]DDEMod:SEARch:PULSe:STATe	ON | OFF	3.6-70
[SENSe:]DDEMod:SEARch:SYNC:OFFSet	<numeric value>	3.6-70
[SENSe:]DDEMod:SEARch:SYNC:PATTern	<string>	3.6-70
[SENSe:]DDEMod:SEARch:SYNC:STATe	ON | OFF	3.6-71
[SENSe:]DDEMod:SEARch:TIME	100 | 200 | 400 | 800	3.6-71
[SENSe:]DDEMod:SRATe	160 Hz to 1.6 MHz	3.6-69
[SENSe:]DDEMod:TIME	1 to Frame Length	3.6-69
[SENSe:]FREQuency:CENTer	0 GHz to f_{max}	3.6-72
[SENSe:]FREQuency:CENTer:LINK	STARt | STOP | SPAN	3.6-72
[SENSe:]FREQuency:CENTer:STEP	0 to f_{max}	3.6-73
[SENSe:]FREQuency:CENTer:STEP:LINK	SPAN | RBW	3.6-73
[SENSe:]FREQuency:CENTer:STEP:LINK:FACTor	1 to 100 PCT	3.6-73
[SENSe:]FREQuency:SPAN	0 GHz to f_{max}	3.6-73
[SENSe:]FREQuency:SPAN:FULL		3.6-74
[SENSe:]FREQuency:SPAN:LINK	CENTer | STOP | SPAN	3.6-74
[SENSe:]FREQuency:STARt	0 GHz to f_{max}	3.6-74
[SENSe:]FREQuency:STARt:LINK	CENTer | STOP | SPAN	3.6-74
[SENSe:]FREQuency:STOP	0 GHz to f_{max}	3.6-75
[SENSe:]FREQuency:STOP:LINK	CENTer | STARt | SPAN	3.6-75
[SENSe:]POWer:ACHannel:ACPairs	1 to 3	3.6-76
[SENSe:]POWer:ACHannel:BANDwidth|BWIDth	0 to 1000MHz	3.6-76
[SENSe:]POWer:ACHannel:MODE	ABSolute | RELative	3.6-77
[SENSe:]POWer:ACHannel:PRESet	ACPower | CPOWer | OBANdwidth | OBWidth | CN | CN0	3.6-77

[SENSe:]POWer:ACHannel:REFerence:AUTO	ONCE	3.6-77
[SENSe:]POWer:ACHannel:SPACing[:UPPer]	0 to 1000MHz	3.6-76
[SENSe:]POWer:BANDwidth|BWIDth	0 to 100PCT	3.6-77
[SENSe:]SWEep:COUNt	0 to 32767	3.6-80
[SENSe:]SWEep:EGATe	ON | OFF	3.6-80
[SENSe:]SWEep:EGATe:HOLDoff	0 to 100s	3.6-81
[SENSe:]SWEep:EGATe:LENGth	0 to 100s	3.6-81
[SENSe:]SWEep:EGATe:LEVel	-5V to +5V	3.6-80
[SENSe:]SWEep:EGATe POLarity	POSitive | NEGative	3.6-81
[SENSe:]SWEep:EGATe:SOURce	EXTernal | RFPower	3.6-81
[SENSe:]SWEep:EGATe TYPE	LEVel | EDGE	3.6-80
[SENSe:]SWEep:GAP	ON | OFF	3.6-82
[SENSe:]SWEep:GAP:LENGth	0 to 100s	3.6-82
[SENSe:]SWEep:GAP:PRETrigger	0 to 100s	3.6-82
[SENSe:]SWEep:GAP:TRGTogap	0 to 100s	3.6-82
[SENSe:]SWEep:TIME	5ms to 1000s	3.6-79
[SENSe:]SWEep:TIME:AUTO	ON | OFF	3.6-79
[SENSe:]TCAPture:LENGth	1024 | 2048 | 4096 | 8192 | 16384	3.6-71
[SENSe]:AVERage:AUTO	ON | OFF	3.6-62
[SENSe]:AVERage:COUNt	0 to 255	3.6-62
[SENSe]:AVERage:TYPE	MAXimum | SCALar	3.6-63
[SENSe]:AVERage[:STATe]	ON | OFF	3.6-63
[SENSe]:BANDwidth|BWIDth:VIDeo	1Hz to 10 MHz	3.6-65
[SENSe]:BANDwidth|BWIDth:VIDeo:AUTO	ON | OFF	3.6-65
[SENSe]:BANDwidth|BWIDth[:RESolution]	1Hz to 10 MHz (model 30) or 10 Hz to 10 MHz (model 20)	3.6-64
[SENSe]:BANDwidth|BWIDth[:RESolution]:AUTO	ON | OFF	3.6-64
[SENSe]:BANDwidth|BWIDth[:RESolution]:MODE	ANALog | DIGital	3.6-65
[SENSe]:DETector[:FUNCtion]	APEak | NEGative | POSitive | SAMPle | RMS | AVERage	3.6-66
[SENSe]:DETector[:FUNCtion]:AUTO	ON | OFF	3.6-66
[SENSe]:ROSCillator:EXTernal:FREQuency	1MHz to 16MHz	3.6-78
[SENSe]:ROSCillator:SOURce	INTernal | EXTernal	3.6-78
SOURce:AM:STATe	ON | OFF	3.6-83
SOURce:DM:STATe	ON | OFF	3.6-83
SOURce:FM:STATe	ON | OFF	3.6-83
SOURce:FREQuency:OFFSet	<numeric value>	3.6-84

SOURce:POWer:ALC:SOURce	INTernal | EXTernal	3.6-84
SOURce:POWer[:LEVel][:IMMediate]:OFFSet	<numeric value>	3.6-84
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]	<numeric value>	3.6-84
STATus:OPERation:CONDition?		3.6-86
STATus:OPERation:ENABle	0 to 65535	3.6-86
STATus:OPERation:NTRansition	0 to 65535	3.6-86
STATus:OPERation:PTRansition	0 to 65535	3.6-86
STATus:OPERation[:EVENt?]		3.6-86
STATus:PRESet		3.6-87
STATus:QUEStionable:CONDition?		3.6-87
STATus:QUEStionable:ENABle	0 to 65535	3.6-87
STATus:QUEStionable:LIMit:CONDition?		3.6-89
STATus:QUEStionable:LIMit:ENABle	0...65535	3.6-89
STATus:QUEStionable:LIMit:NTRansition	0...65535	3.6-90
STATus:QUEStionable:LIMit:PTRansition	0...65535	3.6-90
STATus:QUEStionable:LIMit[:EVENt]?		3.6-89
STATus:QUEStionable:LMARgin:CONDition?		3.6-90
STATus:QUEStionable:LMARgin:ENABle	0...65535	3.6-90
STATus:QUEStionable:LMARgin:NTRansition	0...65535	3.6-91
STATus:QUEStionable:LMARgin:PTRansition	0...65535	3.6-91
STATus:QUEStionable:LMARgin[:EVENt]?		3.6-90
STATus:QUEStionable:NTRansition	0 to 65535	3.6-88
STATus:QUEStionable:POWer:CONDition?		3.6-88
STATus:QUEStionable:POWer:ENABle	0...65535	3.6-88
STATus:QUEStionable:POWer:NTRansition	0...65535	3.6-89
STATus:QUEStionable:POWer:PTRansition	0...65535	3.6-89
STATus:QUEStionable:POWer[:EVENt]?		3.6-88
STATus:QUEStionable:PTRansition	0 to 65535	3.6-88
STATus:QUEStionable:SYNC:CONDition?		3.6-91
STATus:QUEStionable:SYNC:ENABle	0...65535	3.6-91
STATus:QUEStionable:SYNC:NTRansition	0...65535	3.6-92
STATus:QUEStionable:SYNC:PTRansition	0...65535	3.6-92
STATus:QUEStionable:SYNC[:EVENt]?		3.6-91
STATus:QUEStionable[:EVENt?]		3.6-87
STATus:QUEue[:NEXT?]		3.6-92
SYSTem:COMMunicate:GPIB:RDEVice<1|2>:ADDRess	0 to 30	3.6-94

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess	0 to 30	3.6-93
SYSTem:COMMunicate:GPIB[:SELF]:RTERminator	LFEOI | EOI	3.6-94
SYSTem:COMMunicate:SERial<1|2>:CONTrol:DTR	IBFull | OFF	3.6-94
SYSTem:COMMunicate:SERial<1|2>:CONTrol:RTS	IBFull | OFF	3.6-94
SYSTem:COMMunicate:SERial<1|2>[:RECeive]:BAUD	<numeric value>	3.6-95
SYSTem:COMMunicate:SERial<1|2>[:RECeive]:BITS	7 | 8	3.6-95
SYSTem:COMMunicate:SERial<1|2>[:RECeive]:PACE X	ON | NONE	3.6-96
SYSTem:COMMunicate:SERial<1|2>[:RECeive]:PARity[:TYPE]	EVEN | ODD | NONE	3.6-95
SYSTem:COMMunicate:SERial<1|2>[:RECeive]:SBITs	1 | 2	3.6-95
SYSTem:DATE	1980 to 2099, 1 to 12, 1 to 31	3.6-96
SYSTem:ERRor?		96
SYSTem:PASSword[:CENable]	'password'	3.6-96
SYSTem:PRESet		3.6-97
SYSTem:SPEaker:VOLume	0 to 1	3.6-97
SYSTem:TIME	0 to 23, 0 to 59, 0 to 59	3.6-97
SYSTem:VERSion?		3.6-97
TRACe[:DATA]	TRACE1 | TRACE2 | TRACE3 | TRACE4, <block>|<numeric value>	3.6-98
TRIGger[:SEQuence]:HOLDoff	0 to 100s	3.6-100
TRIGger[:SEQuence]:LEVel:VIDeo	0 to 100PCT	3.6-100
TRIGger[:SEQuence]:LEVel[EXTernal]	–5.0 to +5.0V	3.6-99
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	3.6-100
TRIGger[:SEQuence]:SOURce	IMMediate | LINE | EXTernal | VIDeo | RFPower | TV	3.6-99
TRIGger[:SEQuence]:VIDeo:FIELd:SELect	ALL | ODD | EVEN	3.6-101
TRIGger[:SEQuence]:VIDeo:FORMat:LPFRame	525 | 625	3.6-100
TRIGger[:SEQuence]:VIDeo:LINE:NUMBer	<numeric value>	3.6-100
TRIGger[:SEQuence]:VIDeo:SSIGnal:POLarity	NEGative | POSitive	3.6-101
UNIT:POWer	DBM | DBPW | WATT | DBUV | VOLT | DBUA | AMPere	3.6-102
UNIT:PROBe	ON | OFF	3.6-102

UNIT PROBE	
UNIT PROBE	
TRIGger[:SEQuence]:VIDeo:SIGnal POLarity	
TRIGger[:SEQuence]:VIDeo LINE NUMber	
TRIGger[:SEQuence]:VIDeo[:PICTure]:FIELd	
TRIGger[:SEQuence]:VIDeo[:PICTure]	
TRIGger[:SEQuence]:SLOPe	
TRIGger[:SEQuence]:LEVel[:EXTernal]	
TRIGger[:SEQuence]:LEVel:VIDeo	
TRIGger[:SEQuence]:HOLDoff	
TRIGger[:SEQuence]	
TRIGger:SOURce	
SYSTem:TIME	
SYSTem:SREGister	
SYSTem:SECure:CODE	
SYSTem:RESet	
SYSTem:PRESet	
SYSTem:POWer:STATe	
SYSTem:PASSword:CENable	
SYSTem:KLOCk	
SYSTem:ERRor	
SYSTem:DATE	
SYSTem:COMMunicate:SERial:PACE	
SYSTem:COMMunicate:SERial:CONTrol:RTS	
SYSTem:COMMunicate:SERial:CONTrol:DTR	
SYSTem:COMMunicate:SERial:BAUD	
SYSTem:COMMunicate:SERial	
SYSTem:COMMunicate:NETWork:SUBNet	
SYSTem:COMMunicate:NETWork:IPADdress	
SYSTem:COMMunicate:NETWork:GATEway	
SYSTem:COMMunicate:NETWork:DOMain	
SYSTem:COMMunicate:NETWork:DHCP	
SYSTem:COMMunicate:NETWork	
SYSTem:COMMunicate:GPIB:ADDRess	
SYSTem:COMMunicate:GPIB	
SYSTem:COMMunicate	
SYSTem:BEEP	
SYSTem:ALARm	
SYSTem:ALARm:CLEar	
SYSTem:ALARm:ALL	
SYSTem:ALARm:ALL	
SYSTem:ALARm:ALL